AIR CONDITIONING HEATING AND VENTILATING

OCTOBER, 1958—55th Year

Steam Condensers, Refrigeration Room, Los Angeles County's New Central Heating Plant.
See Page 116

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FOR OVER

82

YEARS

engineers and research specialists at Watts Regul Company have directed their knowledge and applied skills to the regulation of pressure (Water, Steam, A Watts has been an outstanding producer of PRESS REGULATORS and PLUMBING and HEATING SAFETY VA and CONTROLS — a dependable source of finest qu products.

For full data on Watts products (the world's larges of Plumbing and Heating Specialties) we invite corres ence.

PRESSURE REGULATORS for Commercial, Industrial, Institutional application . . .

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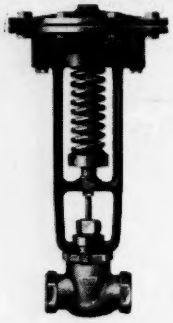
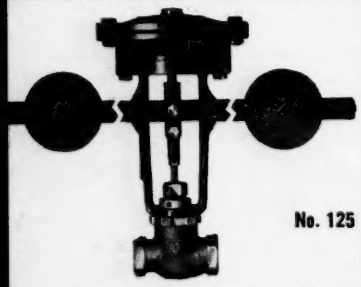


No. 127

WATTS Nos. 127 and 125 Single Seated Pressure Regulators, Sizes ½" to 4". Initial Pressures up to 250 lbs.

No. 127 spring type — Reduced pressure range 10 to 100 lbs.



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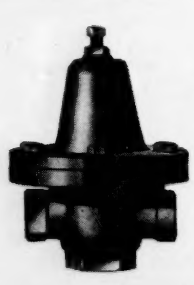
No. 125 weight and lever type — Reduced pressure range 1 to 15 lbs.



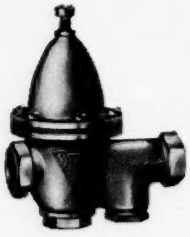
No. 152

WATTS No. 152 Self-Contained Single Seated Pressure Regulator, Sizes ½", ¾", 1".

Iron body construction with bronze trim for initial pressures up to 150 lbs. Reduced pressure ranges 5-40, 25-100 lbs.

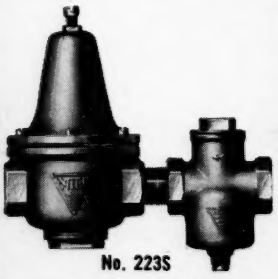
Bronze body construction for initial pressures up to 250 lbs. and reduced pressures up to 200 lbs.

WATER SERVICE



No. 135

WATTS No. 135 Self-Cont... ducing Valve. All bronze ... corporating integral strain... ½" to 2". Initial pressure... 250 lbs. Reduced pressure ... to 75 lbs.



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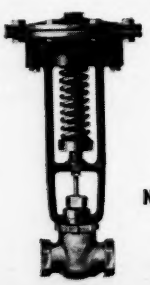
WATTS No. 223 High ... Self-Contained Reducing Va... ½" to 2". Also furnish... separate strainer, specify ... Initial pressures up to 2... Reduced pressure range 30 ...



No. 127W

WATTS No. 127W Remo... Diaphragm Spring Type Pre... ducing Valve, Sizes ... Initial pressures up to 2... duced pressure ranges ... 10 lbs. to 100 lbs.

WATTS

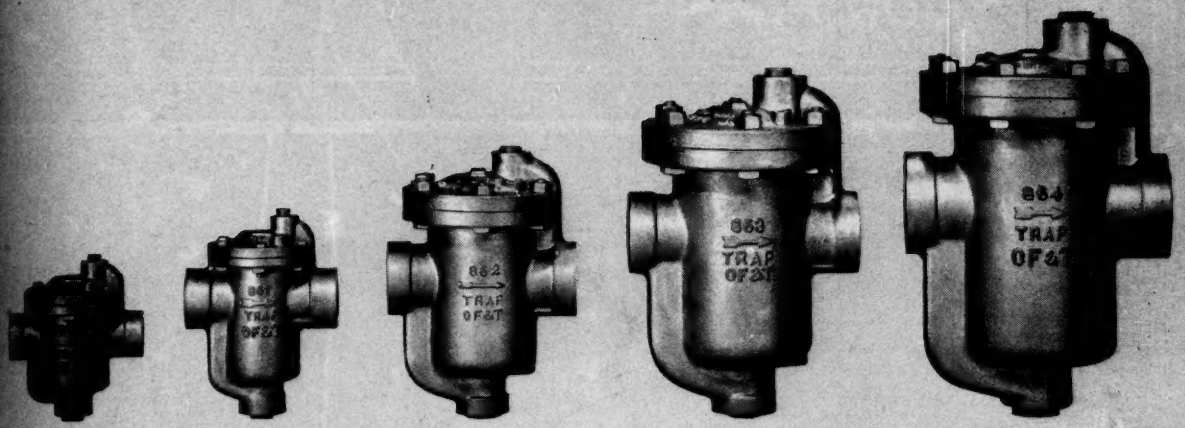
WATTS REGULATOR COMPANY ... Massachusetts, U.S.A.

Send for Folder F-135A (Regulators for Water Service)

Folder F-127B (Regulators for Steam and Air Service)

ANNOUNCING a Complete New Line . . .

ARMSTRONG Open Float and Thermostatic Steam Traps



860 (¾") 861 (1") 862 (1¼") 863 (1½") 864 (2")

Designed and Made by Armstrong Especially for Low Pressure Heating Service

Armstrong Open Float and Thermostatic Traps are the result of the demand by user-owners and contractors for an effective, trouble-free steam trap for heating service.

How They Work

When the steam is first turned on, Armstrong O.F.&T. traps quickly vent the air that has accumulated in the heating units. After start-up, the traps will vent air and CO_2 gas at steam temperature to prevent corrosion of unit heater tubes and other types of finned radiation. Condensate is removed as fast as it accumulates without loss of steam.

Advantages of Armstrong O. F. & T. Traps

The design and construction of Armstrong Open Float and Thermostatic Steam Traps provides outstanding benefits to both the owner and the installing contractor:

LOW COST is made possible by simple, compact design and large volume production.

EASY INSTALLATION. Pipe connections are horizontal and opposite. Traps are supported by the connecting pipes.

INTERNAL CHECK VALVES of 18-8 stainless steel can be furnished with the traps to save cost of installing external check valves.

YEARS OF SERVICE LIFE . . . Working parts are all stainless steel, highly resistant to both corrosion and wear.

MINIMUM MAINTENANCE . . . comes not only from the use of stainless steel parts, but also because the trap is self-scrubbing. Ordinary sediment and sludge are washed right through with the condensate.

Further Information Available

If a trap with these features is of interest to you, get in touch with your nearby Armstrong Representative. Ask him for Bulletin 775 which gives price, dimension and capacity data, or use the coupon below.

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FREE BULLETIN
No. 775 gives detailed information on Armstrong O.F.&T. traps.

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8461 Maple Street, Three Rivers, Michigan
Please send a copy of Bulletin No. 775.

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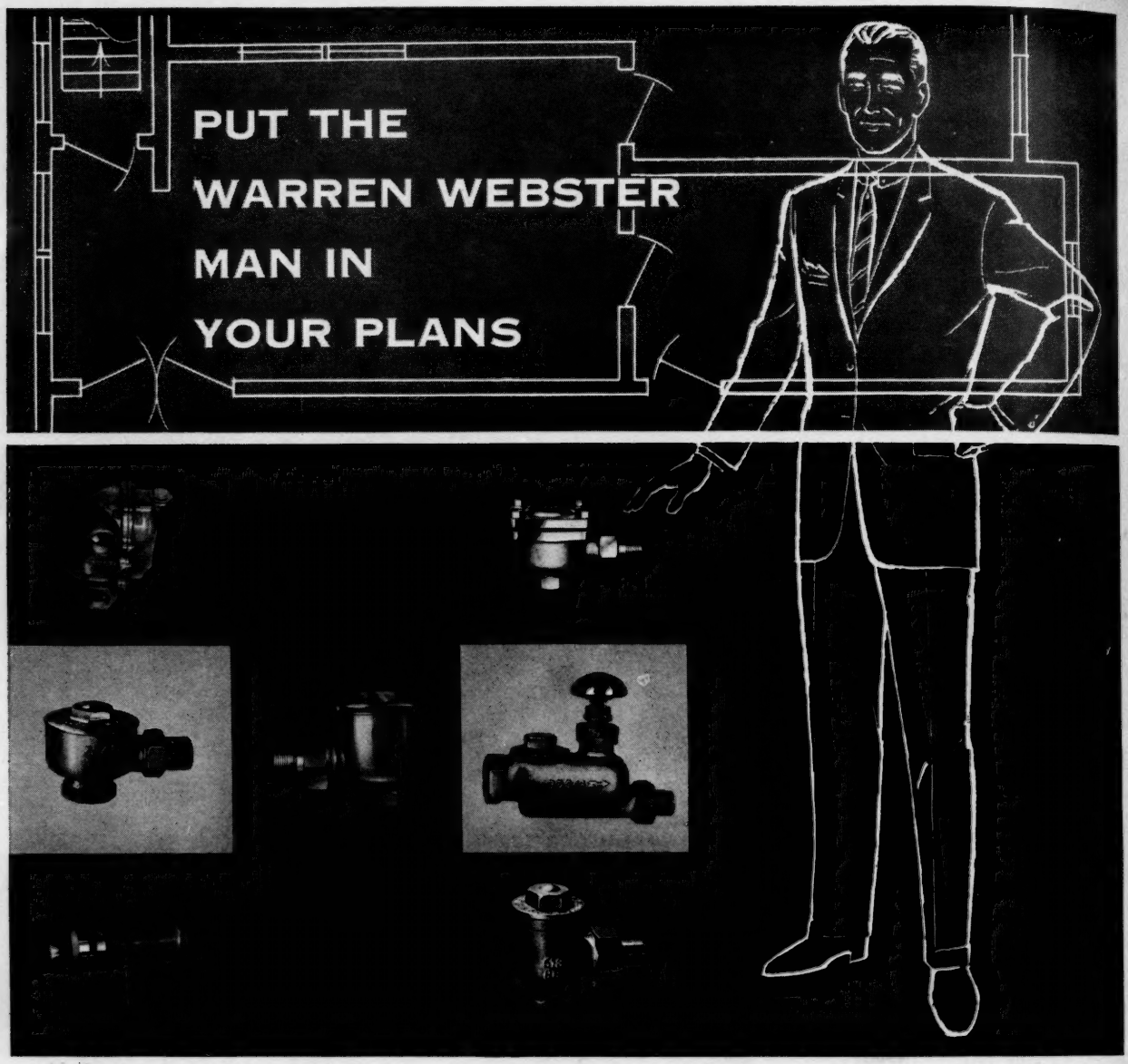


Ask Any Heating Man . . . And You'll Specify "Webster Traps"

Your Warren Webster Man knows traps . . . and any heating man knows the reputation for quality, performance and economy that's built into every Webster Trap.

Webster — the company that made the *first* thermostatic trap — makes a *complete* family of traps to meet every plant engineering need. Heavy-duty, lightweight, trouble-free Webster Series 27 Drip Traps in five sizes . . . thermostatic traps . . . process steam traps . . . dirt strainers — in fact, every steam specialty you need for uninterrupted dependability and low-cost, over-the-years operation.

For 70 years, Webster has made and sold Webster Traps. And today, the Webster line is still the industry's standard. Ask any heating man! Then talk it over with your Warren Webster Man. Or write for our Condensed General Catalog, Bulletin B-151. Warren Webster & Company, Camden 5, New Jersey. Since 1888. Offices in principal U.S. cities and Canada.

WEBSTER'S
FINEST
PRODUCT

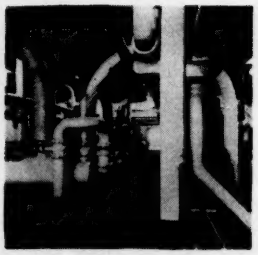
the Warren Webster Man

WARREN WEBSTER
HEATING . . . COOLING

AIR CONDITIONING HEATING AND VENTILATING

Volume 55, Number 10 **October, 1958**

THE COVER



Upper level of refrigeration room where steam is condensed after passing through turbines driving the centrifugal refrigerating machines, Los Angeles County Central Heating Plant, Calif.

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[redacted]

Sharp gains in heavy engineering and residential building in the second quarter almost carried the construction industry to a new record in the first half of 1958, according to the midyear review of construction contracts just published in Building Business, monthly bulletin of F. W. Dodge Corporation. The cumulative total of contracts for future construction in the first six months of 1958 amounted to $16,788,625,000, only 1% below the record level of the comparable 1957 period. The review stated that the greatest increase in any single building type occurred in public buildings, with contracts in this class 71% ahead of last year. Notable increases were also recorded in public works, apartments, hospitals, electric light and power, and recreational buildings.

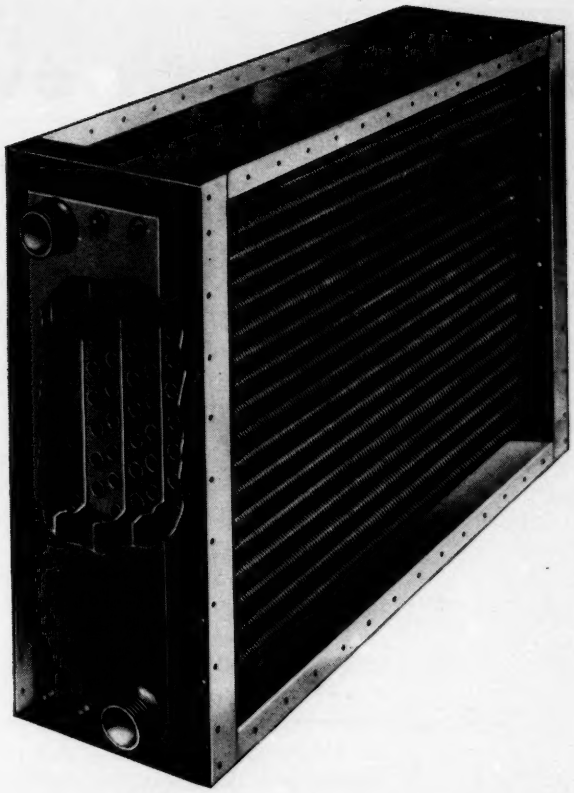
Scientists believe that the present solar utilization systems for heating are about as efficient as they can be made, observed W. A. Danielson, Memphis, Tenn., consulting engineer. The next step before solar heating can begin to take on commercial significance must be through industry rather than further extensive solar research. This next step Mr. Danielson told the Pacific General Meeting of the American Institute of Electrical Engineers, Sacramento, Calif., is development of a low-cost, mass-produced, long-life collector. It must be simple and capable of architectural acceptance, especially until the economics of operation bring about a change in public taste as to what would be considered "not in style".

Problems of noise control and reduction will be dealt with in twelve papers to be presented by specialists in the field at the 9th Annual National Noise Abatement Symposium to be held in Chicago on the 9th and 10th of this month. Papers scheduled for three sessions will concern new developments in noise measurement, jet airliner noise problems, and noise in industry. Noise measurement discussions will cover sound transmission through suspended acoustical ceilings over part-height partitions, effects of room characteristics on sound power measurements, customer acceptance criteria for noise control of residential heating and cooling product, and the noise cumulator, a method for measurement of noise exposure.

The average business man may soon be able to talk to his electronic brain. The U. S. Air Force's Air Materiel Command and the Remington Rand Div., Sperry Rand Corporation, have jointly developed a method which, at present, uses thirty English verbs to instruct business-type computers. To replace the laborious task of manual translation from English to machine language, the new system uses a large-scale computer to make this conversion electronically, for itself and for other makes and models as well.

Housing conditions and requirements of the aged are to be studied by Cornell University under a $160,000 grant by the Ford Foundation. Over 4,000 representative older persons will be interviewed in urban and rural areas. Housing environment and proximity to community facilities, daily living habits and attitudes, income and household expenditures, will be analyzed.

A packaged nuclear power plant passed its first test at the National Reactor Testing Station, Idaho Falls, Idaho. The Atomic Energy Commission project is now self sufficient and is expected to produce 3,000 thermal kilowatts when operating at full power, officials said. The package is designed to produce power and space heat for remote military installations across the Arctic.



AEROFIN TYPE R REMOVABLE-HEADER WATER COILS

• Complete Drainability
• Easily Cleaned
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Completely drainable and easily cleaned, Aerofin Type "R" coils are specially designed for installations where frequent mechanical cleaning of the inside of the tubes is required.

The use of 5/8" O. D. tubes permits the coil to drain completely through the water and drain connections and, in installations where sediment is a problem, the coil can be pitched in either direction. The simple removal of a single gasketed plate at each end of the coil exposes every tube, and makes thorough cleaning possible from either end.

The finned tubes are staggered in the direction of air flow, resulting in maximum heat transfer. Casings are standardized for easy installation.

Write for Bulletin No. R-50.

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Aerofin is sold only by manufacturers of fan system apparatus. List on request.

WASHINGTON OVERTONES

by LORING F. OVERMAN

● Amid the roar of an adjourning Congress, a little-heard overtone is the tinkling clatter of the thousands of pieces of legislation which fail of passage and are swept into Capitol trash baskets. Understandably, the public remembers only the half dozen or so widely publicized or controversial measures; forgets the many which "also ran."

Ways and Means Committee, for example, had 2078 bills and resolutions referred to it for consideration.

Public Works Committee received 748 for consideration; reported out 84, of which 76 were enacted into law.

Foreign Affairs Committee considered 200 bills and resolutions, reported out 33; enactments totalled 28.

Other committees were equally active.

● Ways and Means Committee reported out 101 bills, largest number reported by the Committee in any Congress during the last 20 years. Major tax legislation included:

Technical Amendment Act of 1958—making scores of changes to correct inequities, close loopholes, and provide needed relief for some segments of business.

Small Business Tax Revision Act—having five principal provisions of interest to, but not limited to small business.

Social Security Expansion—increases payments to beneficiaries under the Act; increases tax rate to 2¼% for 1959 and raises tax base from $4200 to $4800.

Tax Rate Extension Act—extending excise, and individual and corporation income tax rates at Korean emergency levels.

Excise Tax Technical Changes Act—designed to correct technical and administrative problems in the excise tax field.

Welfare and Pension Fund Disclosure Act—calls for reporting and disclosure of the financial operations of all private employee welfare and pension benefit plans covering more than 25 employees.

● Even more important than tax action completed is the indication that Washington is beginning to concede the need for a complete overhaul of the tax structure. Business has long contended that present rates are stifling incentive and strangling business expansion.

Hint of Government's recognition of this viewpoint lay in a recent address by Vice President Richard Nixon.

"Our goal," he said, "should be to fashion a tax structure which will create more jobs, more income, and more genuine security. If our economy were to grow at the rate of five percent a year, we would have ten billion dollars more in tax receipts in 1962 than if we were to continue to grow at the recent rate of one and one half percent."

The Vice President then suggested:

"More liberal treatment of depreciation for business taxation purposes. Only in this way can we stimulate the taking of risks by investing in new plants and equipment.

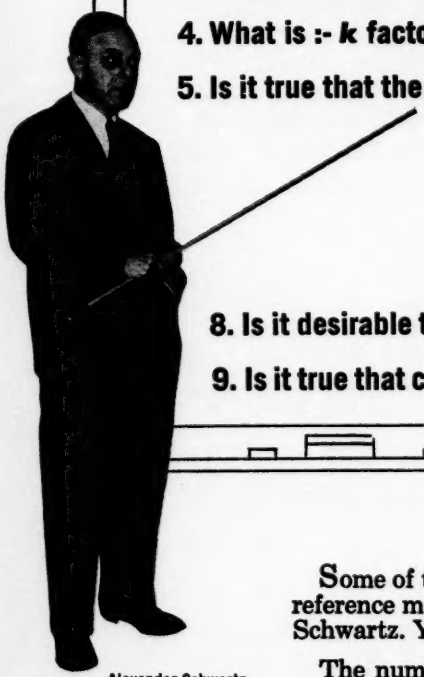
"Even a small cut in the corporate tax rate of fifty-two percent would lead to more rather than less revenue.

"Consideration should also be given to a complete overhauling of the present hodge-podge of excise taxes.

(Continued on page 8)

These are important problems! DO YOU KNOW THE ANSWERS?

1. **Does BRONZE or ALUMINUM paint on an IRON radiator improve or impair its performance?** (19, 20, 22)
2. **Will ORDINARY paint on an IRON radiator improve or impair its performance?** (19, 20, 22)
3. **Is it true that ICE radiates heat at a greater rate than a stove?** (17, 18, 22)
4. **What is :- *k* factor? C factor? Btu? U factor? R factor?** (17)
5. **Is it true that the loss of each lb. of vapor represents a heat loss of 1060 Btu's, or TEN TIMES that which raises the temperature of 1 lb. of water 100°F?** (4)
6. **Does insulation KEEP OUT THE COLD?** (17, 3)
7. **Do thermal insulations create heat?** (3)
8. **Is it desirable to place vapor barriers on both sides of an insulation?** (4)
9. **Is it true that cold does not flow to warm, but heat to cold?** (17, 18, 19)



Alexander Schwartz, writer and lecturer on heat flow, vapor flow, and condensation.

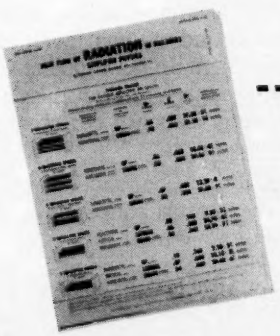
Some of the answers may surprise you! Look them up in a handy, *new* reference manual, "Heat Flow by Radiation in Buildings," by Alexander Schwartz. You may obtain the booklet *free!*

The numbers above refer to pages in this *important contribution* on the theory and practice of insulating against heat and vapor flow, and against destructive condensation. It is replete with simple, illustrated explanations of how to solve many usual and unusual heat flow and fuel problems; also illustrates many new installation techniques.

The author is a well-known lecturer in the field of heat and vapor flow, and thermal insulation. He is president of Infra Insulation, Inc. and author of "Simplified Physics of Vapor and Thermal Insulation," which has been used for years as a text in universities, technological institutes and colleges, and as a valuable reference by architects, engineers, and builders.

In this one handy booklet of 48 pages are assembled and presented in clear, concise, easy-to-follow language:—facts; figures; reports of practical experiments and scientific theories obtainable otherwise only through years of study and consultation of hundreds of books and other publications. It is generously illustrated with drawings, photographs, diagrams, charts.

"Heat Flow by Radiation in Buildings" is yours, FREE, for the asking —Just use the coupon, and get the "answers"!



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FIRM _____

KIND OF BUSINESS _____

ADDRESS _____

WASHINGTON OVERTONES *(Continued from page 6)*

"In the area of personal income the almost confiscatory rates in the highest brackets stifle and prevent risk-taking and encourage tax avoidance devices. The small loss of revenue caused by some reduction of these rates would inevitably be offset by the new investment and business expansion which would result."

The Vice President's concluding comment:

"Prosperity for the American people is inseparable from prosperity for American business. We cannot raise the floor of security unless we raise the ceiling of opportunity. The best way for the American people to improve their living standards is through policies that promote maximum business growth."

● Three indications that business is definitely on the mend are being noted in Washington:

First—Department of Commerce, projecting a survey of business plans, believes industry is on the verge of an upturn in business investment in plant and equipment.

Second—Inventory figures, again a Department of Commerce estimate, indicate that the rate of liquidation is slowing down.

Third—Federal Reserve believes recovery signs are sufficiently strong to warrant a tight rein on credit.

● Housing observers are hoping that credit restrictions will not be drawn so tightly that the present upward movement in private residential construction will be interrupted. As matters now stand:

Seasonally adjused annual rate of private starts for the first eight months of 1958 averaged 1,037,000 units, compared with an average rate of 982,000 for the same period last year.

Private dwelling units put under construction in August rose to 108,800—up 12% from August of 1957. Public housing starts, with 10,400 units in August, compared with 3,700 in July, were largely responsible for the upturn.

Senator Sparkman, Chairman of the Senate Banking Committee's Housing Subcommittee, has given a pledge to the U. S. Conference of Mayors. He will start work "as soon as possible" for a housing bill to fill gaps left by the 1958 omnibus housing bill, which failed to pass the House.

Quick action will be needed, the Senator indicated. One reason, he said, is that 247,000 families will be displaced from their homes during the next 30 months because of Government action. Urban renewal will move 83,000; highway construction, 75,000; and 89,000 will be moved by such other Government actions as public construction, code enforcement, and demolition of temporary dwellings.

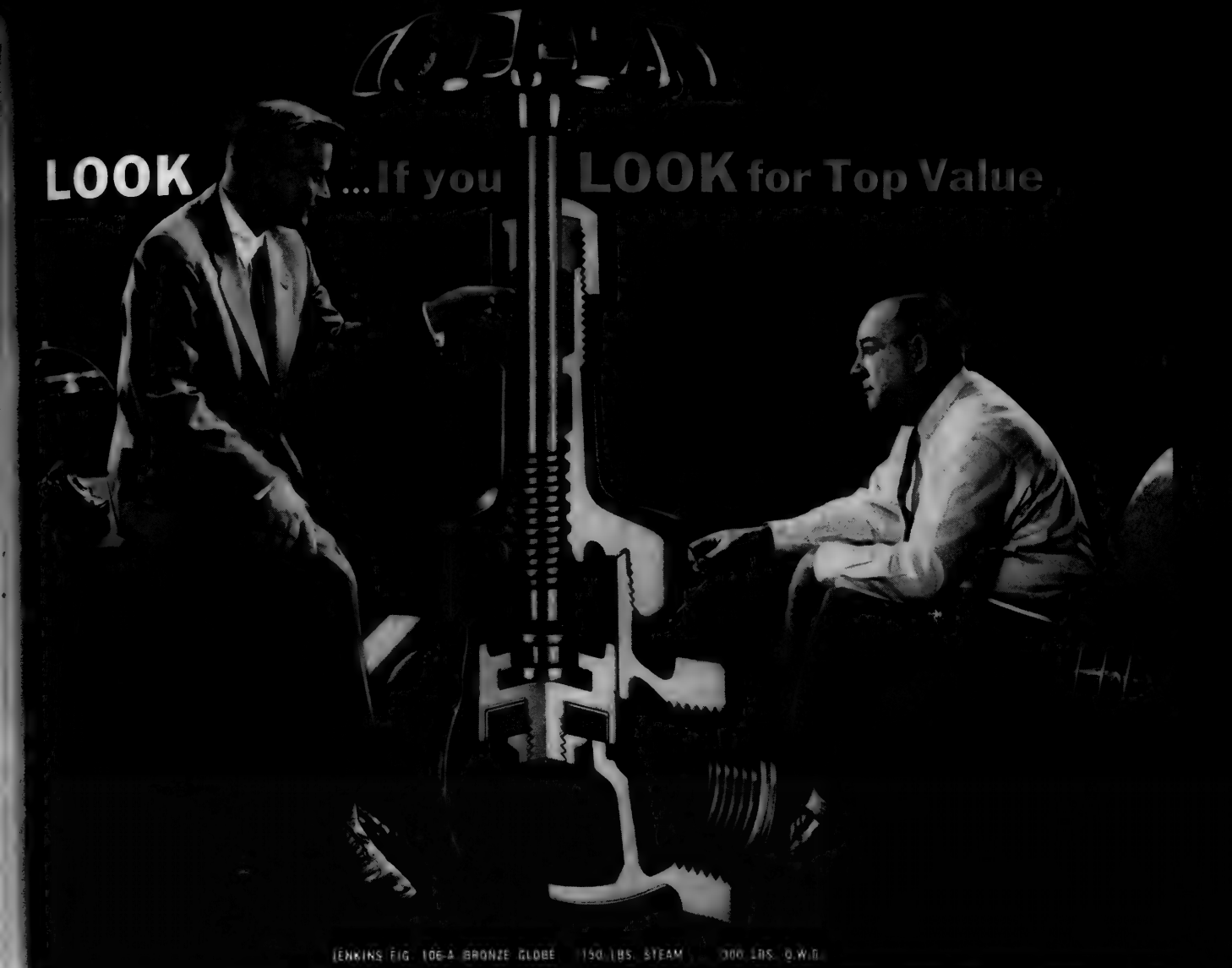
● President Eisenhower has signed Senate Joint Resolution 135, authorizing a $10-million expanded program to construct five demonstration plants—three for the conversion of sea water, and two for the conversion of brackish water to potable and industrial uses. Each plant will explore a different method.

Senator Clinton Anderson, principal proponent of the program, has forecast that by 1975 the United States, with 200,000,000 population, will be faced with a fresh water shortage in many industrial and agricultural areas.

● Producers and distributors of gas-fired equipment will welcome announcement that the Federal Power Commission has authorized a $167,000,000 expansion in natural gas transmission and storage facilities. The authorization covers four applications by Transcontinental Gas Pipeline Corp., of Houston, Texas, and 38 applications by 26 gas producers. Transmission and storage facilities will be used primarily to serve eastern seaboard customers.

● The Congressional Joint Economic Committee has asked 1500 economists in 150 universities for suggestions concerning stabilization problems which may have to be faced by the 86th Congress.

Among other questions, the economists were asked for their views on making available standby authority for direct controls on investment, credit, prices, and wages.



in Disc Equipped Bronze Valves

LOOK at that Wheel — Tough malleable iron. Design unequalled for cool, sure grip.

LOOK at the Index Plate — Has Fig. No. etched in green background. Held by wheel nut which is secured by rolled-over spindle end.

LOOK at that Spindle — Made of high tensile bronze. See how much heavier it is . . . how many more deeply cut threads engage bonnet. And, the crowned head that reduces friction on disc holder. Sure, it costs more to make a spindle this way. But it reduces wear, preserves packing, means easier operation.

LOOK at the Packing Nut and Gland—Note the heavy and deep bronze hex. And, that bronze gland designed to compress packing toward spindle.

LOOK at that Packing Box — Its depth equals 1½ times spindle diameter. More packing space means less repacking. An asbestos, lubricated and graphited packing is used.

LOOK at that Bonnet — One-piece, screw-over design with big hex surfaces is easy to remove. Take an extra look at the bevel joint between bonnet and body, serving as an internal brace against the crushing effect of the bonnet assembly. Millions of Fig. 106-A in use for years prove this unique design licks distortion and springing.

LOOK at the Disc Holder — It's the Slip-on Stay-on type originated by Jenkins. Correct protective depth prevents flaking or cracking of disc.

LOOK at the Disc — Easily renewed without removing valve from line. Made of compositions to suit various services . . . and **made by Jenkins**, the only maker of both valves and discs.

LOOK at that Body — Just compare wall thickness of this high tensile bronze body with any other valve. The factor of safety is many times higher than rating requires. See the curved diaphragm to protect seat from distortion by pipe strain. Note that the raised seat is higher to permit more reseating operations . . . and wider, so it won't cut into disc. Pipe threads are full length and clean cut.

LOOK at this . . . for Throttling

—Just replace the standard disc nut with this Throttling Nut and a Fig. 106-A becomes well-suited to throttling service. This unique nut reduces the effects of wire drawing and its long legs restrict flow for accurate control. Many plants take advantage of this versatile valve to reduce valve and parts inventory.

THE FIRST renewable composition disc valve was a Jenkins Valve, originated nearly a century ago. Compare today's Fig. 106-A Bronze Globe with any other. See why so many valve users agree that a *Jenkins* is still the FIRST for top value. For descriptive folder No. 189-B on the full line of Jenkins Bronze Globe, Angle and Check Valves write to Jenkins Bros., 100 Park Avenue, New York 17.

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VALVES

SOLD THROUGH LEADING DISTRIBUTORS EVERYWHERE

BRIEFLY STATED

ENGINEERING SOCIETIES

Comfort responses in certain regions of its Comfort Chart are being re-evaluated at the Research Laboratory of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Cleveland, Ohio. According to E. F. Snyder, ASHAE research committee head, this is one of a number of long-term projects planned for the new environment test room completed this year. The medical-physiological aspects of testing with people are under the guidance of Walter Koch, M.D., Ph.D., researcher and lecturer at Hebrew University, Jerusalem, and former assistant section head, Dept. of Medicine, Vienna Poliklinik, Austria . . .

ASHAE was represented at the International Congress for Heating and Air-Conditioning in Brussels, Belgium, last month by C. F. Kayan, New York City; ASHAE Director of Research B. H. Jennings; and J. Barrie Graham, Buffalo, N. Y. Mr. Jennings presented a paper entitled "A Critique of Current Knowledge and Research Relative to Human Comfort and Environment". At the same session, G. A. Parmelee, formerly with the Research Laboratory staff, and now with the Arabian American Oil Co., Dhahran, Saudi Arabia, delivered a paper entitled "Air Conditioning Requirement in Remote Desert Area" . . .

For its 45th Semiannual Meeting, to be held at the Roosevelt Hotel, New Orleans, La., December 1-3, the AMERICAN SOCIETY OF REFRIGERATING ENGINEERS is arranging a heavy technical program, consisting of twelve papers by leading authorities in refrigeration and air conditioning, backed by three conferences and six forums. There will also be a research exhibit featuring precommercial development work of twelve manufacturers. Customary Council and committee meetings will be held on directly preceding days as well as upon those with scheduled program events. The New Orleans Section, as host for the occasion, has plans for a social program of memorable proportions. On December 1 the vote will be taken to decide whether or not the members approve merger with the American Society of Heating and Air-Conditioning Engineers. Members of ASHAE will ballot upon the same question at a special meeting to be held on the same date in Chicago . . .

Design of an absorption cooler operated by heat from a flat plate solar collector with a collector suitable also for providing winter comfort heating, was presented last month in Salt Lake City during the national meeting of the AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Design, which calls for a cooler of nominal capacity of 8,000 Btu per hr was given in a paper by R. Chung, G. O. G. Lof, and J. A. Duffie of the University of Wisconsin. Cooler uses a well-designed flat-plate 107 sq ft collector to provide nominal cooling capacity for 8-hr working day. Energy storage equivalent to approximately 2-hr cooling capacity is necessary for this application, either between the collector and the generator of the air-conditioner, or between the evaporator of the conditioner and the space to be cooled. The same collector is also suitable for winter heating. Combined heating-cooling competitive with conventional systems in areas of high energy costs in the near future is predicted.

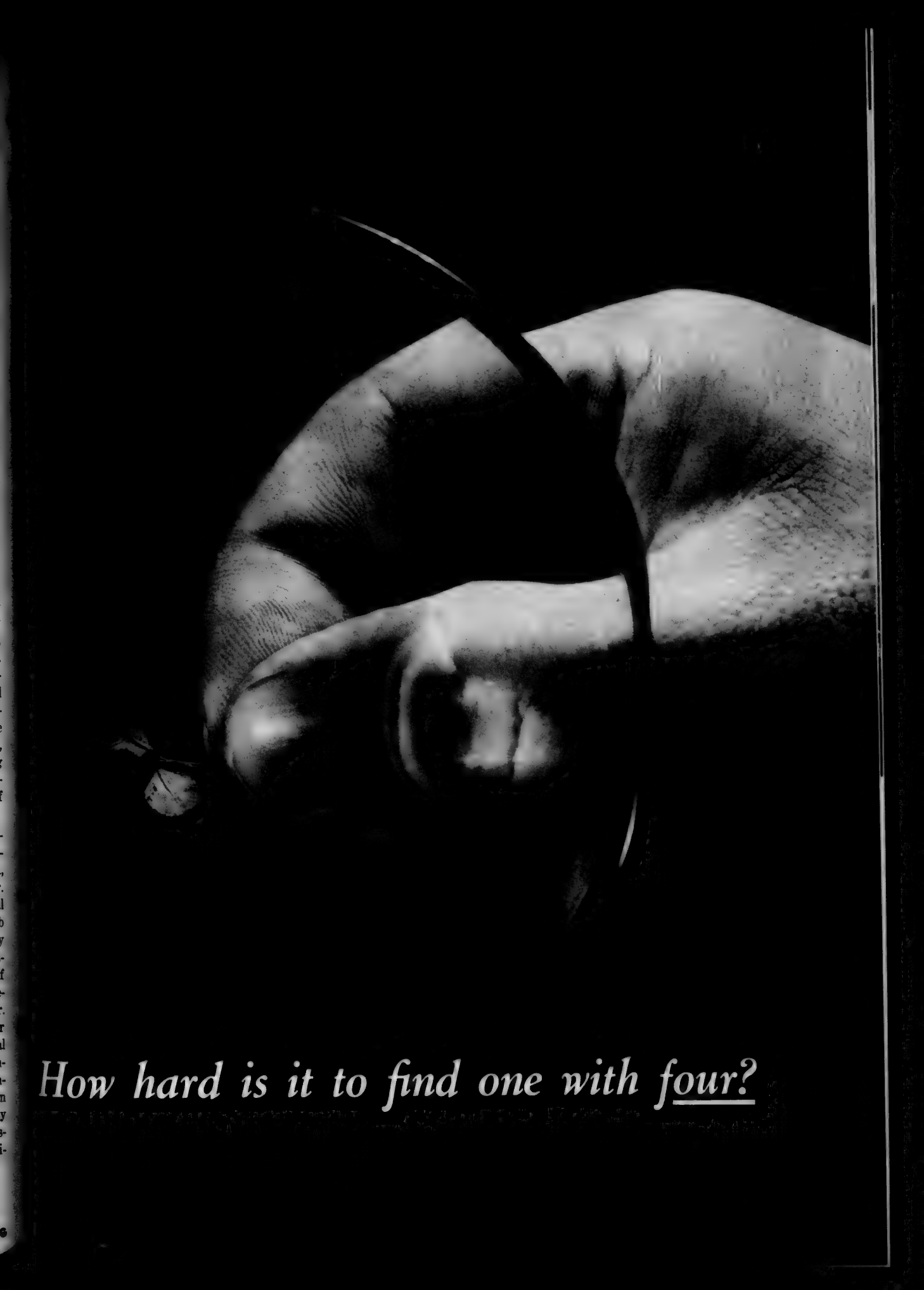
WITH THE ENGINEERS

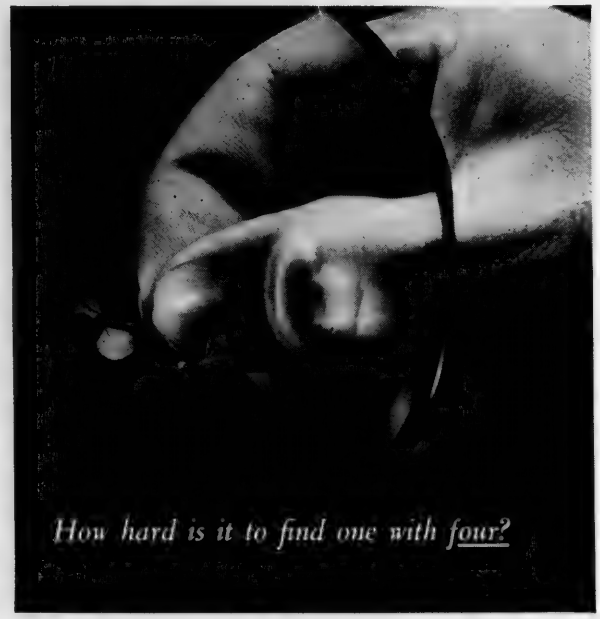
Removal of engineering offices of ROBERT P. SCHOENIJAHN to 800 Woodlawn Ave., Wilmington 5, Del., was announced. . . FREDERIC R. HARRIS, INC., consulting engineers, 27 William St., New York 5, N. Y., and New Orleans, has established a subsidiary in Europe to service its clients in Europe and the Middle East. It is FREDERIC R. HARRIS (HOLLAND) N.V., Korte Vijverberg 5, The Hague, Netherlands. Services include waterfront terminals for petroleum, dry bulk and general cargo as well as related upland facilities, soil mechanics, difficult foundations, floating dry docks and graving docks, and steam and diesel power plants . . .

Dan G. Gillham has joined the consulting engineering firm of DUDLEY DEANE AND ASSOCIATES, 182 Second St., San Francisco 5, Calif., as vice president and chief electrical engineer. Formerly a Deane associate, Gillham has been most recently with International Engineering Company as senior engineer in charge of electrical work at Oxbow and Hell's Canyon dams in Idaho . . . William H. Byrne, Consulting Engineer announces formation of NUCLEAR SAFETY DIVISION OF BYRNE ASSOCIATES, INC., 50 Broadway, New York 4, N. Y., and Freeport, L. I., N. Y. The Division will be under the direction of Dr. James B. Kelley, formerly consultant to the State of New York on atomic energy, who has been actively engaged in the field since 1942. The Nuclear Safety Division will offer specialized services in planning new laboratory and plant facilities and in remodeling existing facilities for maximum protection against radiation for employees, members of the community, and equipment. In connection therewith, the Division will also offer such other engineering services as ventilation, air conditioning design, electrical layouts and structural design. A brochure of services is available . . .

William A. Devitt has been appointed manager, advertising and public relations of THE KULJIAN CORPORATION, ENGINEERS AND CONSTRUCTORS, Philadelphia, Pa. Most recently with Leeds & Northrup Co., Mr. Devitt was formerly associated with the Industrial Publicity Department at Arndt, Preston, Chapin, Lamb & Keen, Inc. . . . Appointment of Theodore M. Pinney as district engineer, and Edmund W. Hollister as assistant manager, of the 14-state Cleveland District of THE AUSTIN COMPANY, ENGINEERS AND BUILDERS, Cleveland, Ohio, was announced. From 1951 to 1953, Mr. Pinney served as the firm's chief project engineer for the Atomic Energy Commission's Argonne National Laboratory and for its Rocky Flats facility near Denver. Mr. Hollister, former New York University instructor in thermodynamics, was in charge of design of all mechanical installations at the Chicago Army Aircraft plant, where Douglas built C-54 Army transports during World War II, and is a registered engineer in thirty states.

(Concluded on page 14)


How hard is it to find one with four?



When it's unit heaters . . .

When you want unit heaters you don't have to look far afield . . . or even look *over* the field. All you need do is look to Ilg. For *only* Ilg has everything you need in the way of unit heaters.

No matter what source of heat you prefer—gas-fired,

Only ILG *gives you*

Gas-Fired Unit Heaters. Ilg Model 35M—now the smallest and lightest 35,000 Btu./hr. input model on the market. Only 18" high, 14" wide, 66 pounds in weight. Complete line includes ten basic models from 25,000 to 250,000 Btu./hr. input. For use with natural, manufactured, mixed and liquefied petroleum gases.

All-Electric Unit Heaters. Pick any capacity from 1½ to 30 kw. and Ilg will furnish the unit you need. All heaters have non-glowing, steel sheathed heating elements . . . super-quiet aluminum fan wheel . . . permanently lubricated motor . . . built-in protection against overheating. All parts fully protected by Ilg's famous "One-Name-Plate" guarantee.

For unit heaters built to satisfy your "specs"...

you're in clover when you look to ILG

all-electric, steam or hot water—Ilg has the unit to meet your demand, in a variety of types and sizes.

So why shop around? Put all unit heater responsibility on Ilg—the *only single source* that has all four types of heaters—and you eliminate heater headaches.

For further details, write for Bulletin 807 on electric heaters, Bulletin 1202 on horizontal and vertical heaters, Bulletin 286 on gas-fired heaters, Bulletin 1306 on cabinet heaters.

all four types of unit heaters

Steam and Hot Water Cabinet Heaters. Seven basic sizes; 21 hot water ratings; 14 steam ratings. Heavy-gauge steel casing. Choice of blow-through type with direct-drive fan assembly or draw-through type with belt-driven fan. Available for floor, ceiling, wall or inverted mounting; non-recessed, semi-recessed, fully recessed, or concealed installation.

Steam and Hot Water Horizontal and Vertical Heaters. *Horizontal* models in 19 capacities. Heating coils are rounded copper tubes hydraulically expanded for tight bonding to aluminum fins; totally enclosed motors. *Vertical* models in 15 capacities; two types—for standard and low outlet air temperatures. Coil construction similar to horizontal heaters.

specify ILG®

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2851 N. Pulaski Road, Chicago 41, Illinois
Offices in 57 Principal Cities
Member of Air Moving and Conditioning Association Inc. (AMCA)

BRIEFLY STATED

(Concluded from page 10)

AMONG THE ASSOCIATIONS AND INSTITUTES

The Building Owners and Managers Study Group, BUILDING RESEARCH INSTITUTE, Washington, D.C., is formulating plans for a workship meeting on selection and maintenance of windows, to take place later this fall. Chairman Howard Phillips of American Telephone and Telegraph Company and his planning committee are currently attempting to develop a list of all BRI members who have interests in this area for use in selecting program participants. Letters have been sent to all firms known to be closely identified with the field, but others interested are urged to write Harold Horowitz, BRI technical secretary, for further details or to submit suggestions for speakers or subject matter. Present program outline includes consideration of glass area requirements, height and width relationships, glass, frame and sash, sealing, and shading devices . . .

A major research program is being sponsored by the ASSOCIATION OF EDISON ILLUMINATING COMPANIES and EDISON ELECTRIC INSTITUTE, representing the investor-owned electric utility companies, and BITUMINUS COAL RESEARCH, INC., representing the coal industry. The projects, to be conducted during a two-year period, will be undertaken in the BCI laboratories. The research organization will attack both ends of a problem involving the reduction of sulfur dioxide and other contaminants in flue gas as produced and the reduction of sulfur in steam coals prior to burning. At present, methods for removing contaminants from flue gases are economically unattractive . . .

Preparations for the 11th Industry Exposition of the AIR-CONDITIONING AND REFRIGERATION INSTITUTE got under way last month when the newly-appointed Exposition Committee held its first meeting at ARI headquarters, it is announced by Robert H. Luscombe, manager of marketing, Penn Controls, Inc., chairman. The Exposition will be held in Atlantic City, N. J., November 2-5, 1959. Members of the committee include: Byron Halstead, senior partner, Halstead & Mitchell; R. H. Israel, sales manager, Refrigeration Dept., Virginia Smelting Company; B. E. James, president, McQuay, Incorporated; George E. Mills, ARI show director; John Morrill, general manager, Evansville Div., Bendix-Westinghouse Automotive Air Brake Company; J. A. Mulcahey, vice-president and director of sales, Dunham - Bush, Inc.; Austin Rising, vice - president, York Div., Borg-Warner Corporation; W. A. Siegfried, president, Superior Valve & Fittings Company . . .

BURGEONING BUSINESS

NU - WAY CORPORATION, Rock Island, Ill., has announced its purchase of a controlling interest in SUNSTRAND ENGINEERING CO., of Rockford, Ill. The Sunstrand line will remain a separate entity, and both burner lines will be maintained unchanged, it was stated. Manufacture of Sunstrand burners will be transferred to Nu-Way's Rock Island plant. Under terms of the purchase agreement, Sunstrand will operate as a division of the Nu-Way firm . . . CLEAVER-BROOKS COMPANY, Milwaukee, Wis., announced plans to establish its Special Products Division as a separate corporation. The new firm will be named CLEAVER-BROOKS SPECIAL PRODUCTS, INC. Its sales area has expanded so greatly in recent years that it is now too important to be a part of the parent company, it was stated.

ARKOS MANUFACTURING COMPANY has been formed as the production division of ARNOLD KOSARIN & ASSOCIATES in Detroit, Mich., to produce a new line of direct fired heaters. The firm is headed by Arnold A. Kosarin, consultant to the warm air heating industry for the past 30 years. Mr. Kosarin is well known for his pioneering of direct fired heaters as early as 1939. Bulk of the manufacturing, assembly, and flame testing of the new units will be performed in company facilities in the former Packard plant in Detroit. Sales and engineering offices will be maintained at 7310 Woodward, Detroit . . . ROBBINS & MYERS, INC., Springfield, Ohio, electric motor manufacturer, has purchased TRADEWIND MOTORFANS, INC., Pico Rivera, Calif. . . .

NATIONAL-U. S. RADIATOR CORP., Johnstown, Pa., will dedicate its new Engineering Center in the company's Research Park on Thursday, October 16th. The ceremonies will follow a luncheon to be given by the directors of the corporation, at which Dr. Eric A. Walker, president of Pennsylvania State University, will be the guest of honor and principal speaker. Guests will include business and civic leaders of the Johnstown area and representatives of the business press and professional societies . . .

SPENCE ENGINEERING CO., INC., Walden, N. Y., announces appointment of the R. C. BECKERT CO., 110 East 42nd Street, New York City, as sales representative for Spence equipment in New York City and northern New Jersey . . . Sales engineer Bill Sullaway is appointed head of the new HESS, GREINER AND POLLAND sales office at 3150 El Cajon Boulevard, San Diego, Calif., and will handle Recold air conditioning equipment, Anemostat air diffusers, Waterloo grills and registers, and Continental air filters . . .

AIR DEVICES INC., New York City, has acquired the complete line of registers and grilles formerly manufactured by Stewart Manufacturing Co., Kinston, N. C. These registers and grilles will now be marketed under the trade name AGITAIR and will be manufactured in Pennsylvania.

CONSULTANTS POLLED

ILG ELECTRIC VENTILATING CO., Chicago, Ill., hired an independent research organization to ask 2,000 consulting mechanical engineers which of 13 listed points were of greatest importance in specifying electrical propeller fans, centrifugal fans, and blowers. *Quietness* won, followed closely by *vibration-free operation*, and *long life*. Next came *low maintenance cost, accessibility of parts* for ease of repair, *relative efficiency*, and *low operating cost*. There followed a contest to guess how the engineers voted. There were 4,000 entries. Although the answers differed to some extent in order of preference, the top seven points mentioned above were common to men in both groups.

MINUTEMAN!

Your steel service center starts delivery even as you place your order!

In every way, your local steel distributor is geared to keeping production lines rolling.

He's ready to rush the amount, quality, size and shape of steel to meet almost any conceivable demand—on the double. He's your on-the-spot insurance against the plant shutdowns and lost contracts that can be caused by in-plant steel shortages.

On a regular basis, his facilities, stocks and fast delivery service can be integrated with your production needs. He is, truly, the service center of the steel industry. And he's only a phone call away.

Call him for any quantity of Weirkote continuous-process zinc-coated sheets, Weirzin electrolytic zinc-coated sheets, hot- or cold-rolled sheets or any type of steel you may need for any type of production job.

WEIRTON STEEL COMPANY

WEIRTON STEEL COMPANY

WEIRTON, WEST VIRGINIA

a division of

NATIONAL STEEL CORPORATION

Scientific Frontiers

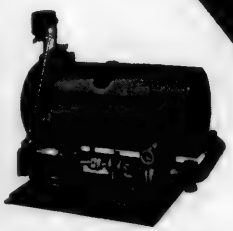
• Curtiss-Wright Corporation has reported receipt of a contract from the Atomic Energy Commission to build a nuclear facility for atomic food irradiation by gamma rays. The installation, expected to be completed in mid-1960 at Lathrop, Calif., for the Army Quartermaster Corps, will be a versatile food processing plant capable of preserving a variety of foods by killing or inactivating micro-organisms that cause food spoilage. Process will make fresh foods available under field conditions, reduce refrigeration requirements and food losses, and more effectively control some food-borne diseases.

• Study is being done at Purdue University's Agricultural Engineering Department by G. M. White and G. W. Isaacs in developing solar-powered refrigeration systems for applications which require cooling principally during periods of high insolation, such as livestock shelters. Designs for livestock shelters are being investigated for reducing thermal lag, thereby increasing the coincidence of maximum cooling load and maximum intensity of solar radiation. Both closed and open cycle absorption refrigeration systems are being analyzed for feasibility in this application. Ultimate objective of project is to determine the best combination of solar collector, refrigeration cycle, and animal shelter for reducing summer heat stress on livestock.

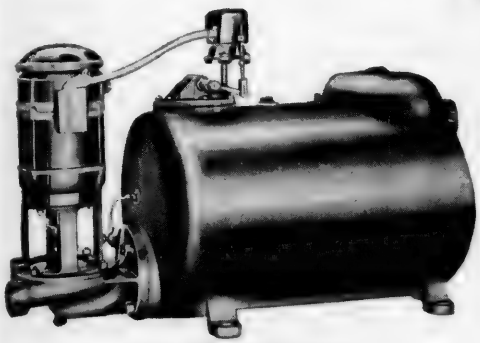
• Shock waves given off in an explosion can make steel harder than can be done by cold rolling, according to Los Alamos scientists. The shock causes a rearrangement of the crystal structure of the metal without changing any of the metal's dimensions.

• Joseph Kaye and George N. Hatsopoulos of the department of mechanical engineering at the Massachusetts Institute of Technology have developed an engine without moving parts that will convert heat directly to electricity. The device, called a thermo-electron engine, takes heat from any source, including solar energy, and by means of two plates, one relatively hot and one relatively cold, a flow of electrons is induced. The MIT model is said to have produced power with thermal efficiency of about 12%, as compared with General Electric Research Lab's thermionic converter which operates at efficiency of 8%, and a conventional thermocouple's 1%.

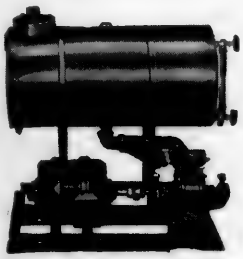
• Radioactive waste products from nuclear reactors can be used in batteries as a source of electrical energy, according to Arthur D. Little, Inc. In one type, high-speed electrons from the radioactive source (beta particles) are collected by an adjacent conductor of electricity; in a second type, beta particles produce ions in a gas and these, in turn, stimulate current flow from two dissimilar metals; and in the third type, radiation triggers the operation of a semiconductor diode, similar to the now-familiar transistor. All three are still in the development stage and operate at low levels of current, but they can be expected to find wide use in low-power electrical equipment, both military and commercial.



"HS" CONDENSATE PUMP



"VC" CONDENSATE PUMP



"TM" TURBINE PUMP

"UV" CONDENSATE PUMP

TOM JOB

A standard type Skidmore Pump will meet the exacting requirements

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- **TYPE "HS"**

  Sturdily constructed for dependable service at small investment — capacities 1,000 to 65,000 sq. ft. E.D.R., discharge pressures from 10 to 75 lbs.

- **TYPE "VC"**

  Ideal for handling hot condensate, unit operates quietly, and is easily accessible for inspection — capacities 1,000 to 65,000 sq. ft. E.D.R., and discharge pressures from 10 to 75 lbs.

- **TYPE "TM"**

  Completely assembled on either steel or cast iron base—capacities, for boilers up to 250 H.P., with discharge pressures to 150 lbs.

- **TYPE "UV"**

  Designed for low return installations — capacities, 2,000 to 40,000 sq. ft. E.D.R. and discharge pressures from 10 to 75 lbs.

Write for bulletins of the Skidmore Pumps listed above.

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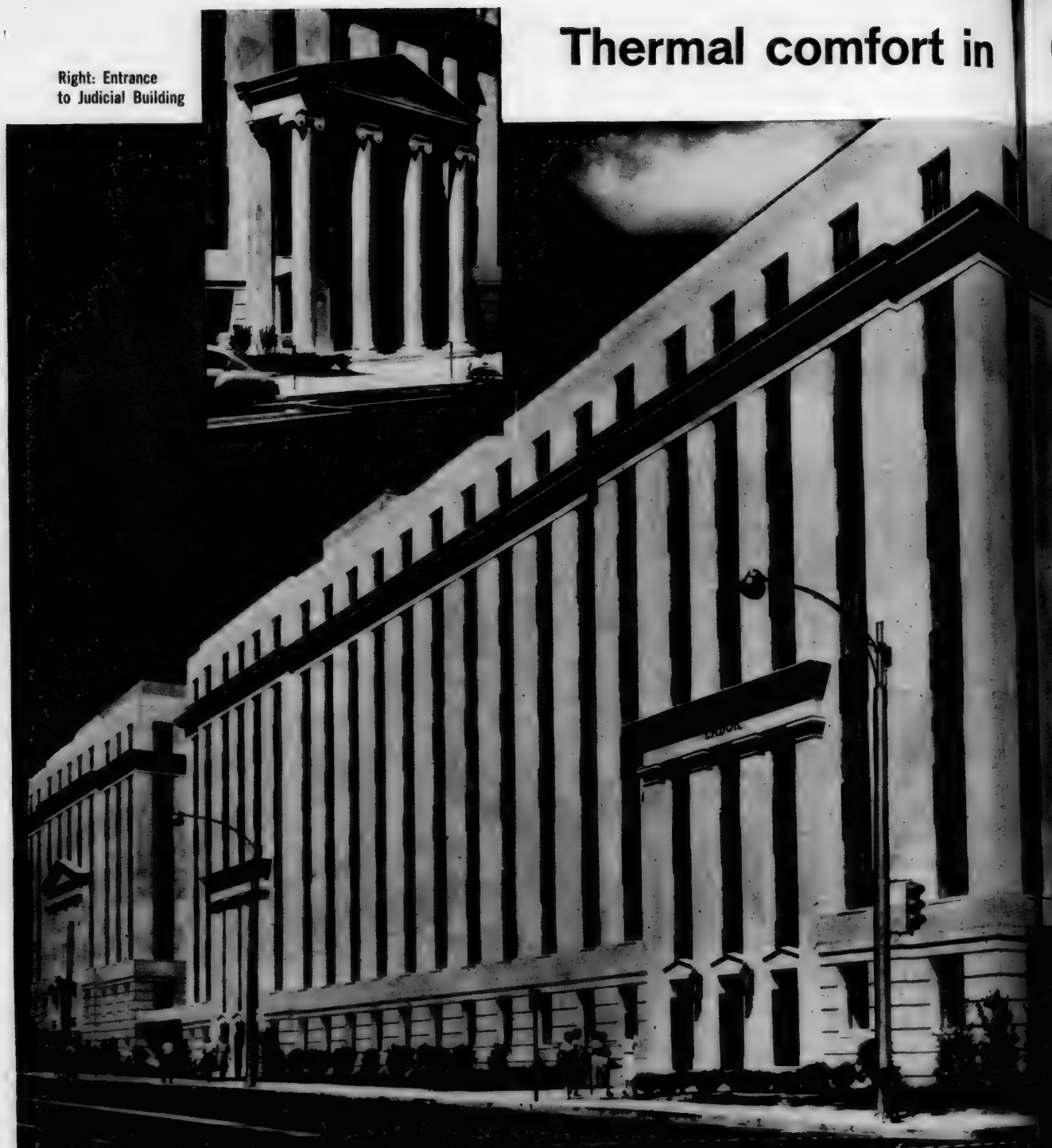
Choose with Confidence!

Thermal comfort in



Right: Entrance to Judicial Building

JUDICIAL, OFFICE and LABOR BUILDINGS, ATLANTA, GEORGIA

Architects for all buildings: **A. Thomas Bradbury & Associates,** Atlanta, Georgia

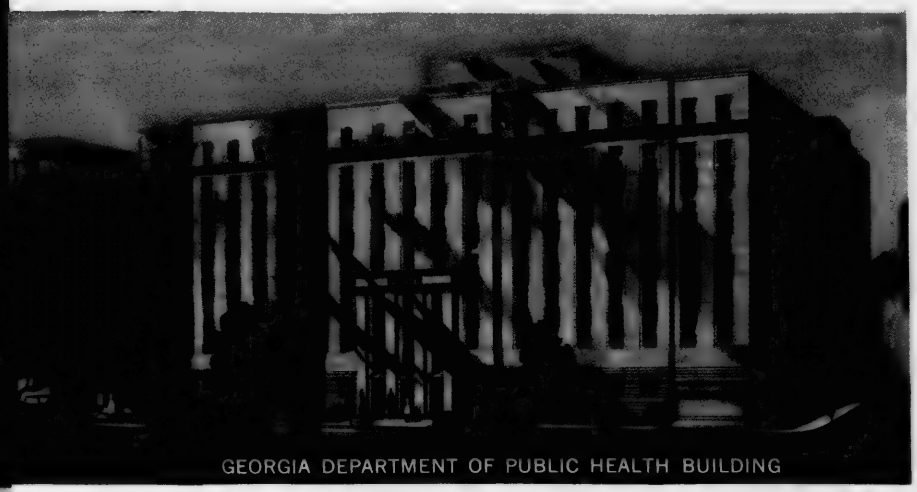
JUDICIAL, OFFICE AND LABOR BUILDINGS also DEPT. OF AGRICULTURE BLDG.
General Contractor: **Thompson-Street Co.** • Mechanical Engineers: **Newcomb & Boyd**
Mechanical Contractors: **Huffman-Wolfe Southern Corp.**

DEPARTMENT OF PUBLIC HEALTH BUILDING
General Contractor: **George A. Fuller Co.** • Mechanical Engineers: **Brewer & Mundy**
Mechanical Contractors: **James E. Smith & Sons, Inc.**

Georgia's proud new Capitol Hill buildings

assured by POWERS Control

Air Conditioned Comfort throughout these distinguished buildings and the Executive Suite in the old Capitol Building is automatically regulated by Powers air conditioning control systems.



GEORGIA DEPARTMENT OF PUBLIC HEALTH BUILDING

Throughout the huge Judicial, Office and Labor Building, the perimeter under-window remote air conditioning units are controlled by 254 Powers Heating-Cooling remote bulb thermostats operating 817 Powers Packless Control Valves—Eight central fan systems under Powers control provide conditioned air for the interior zones. Similar controls, involving the use of 113 Powers H-C thermostats and 317 Packless Control Valves are used for perimeter unit conditioners in the Agriculture Building.

The Department of Health Building, now under construction, will be equipped with a complete Control Center Panel from which the entire air conditioning system can be operated and all thermal conditions checked. Powers control system for this building includes individual room control of all perimeter unit conditioners. Interior zones are served by high-pressure dual duct systems with individual controls of each mixing box unit. Central chilled water and hot water systems for all buildings are Powers controlled.

Dependable Year after Year performance of Powers control systems in these monumental buildings will pay back a highly profitable return in fuel savings, comfort and lowest cost for maintenance.

In Your New Building whether it be a school, hospital, church or commercial building ask your architect or engineer to include a Powers Quality System of Temperature and Humidity Control.

Entrance to AGRICULTURAL BUILDING which is completely air conditioned and Powers controlled. Marble sculptures show Georgia farm products.

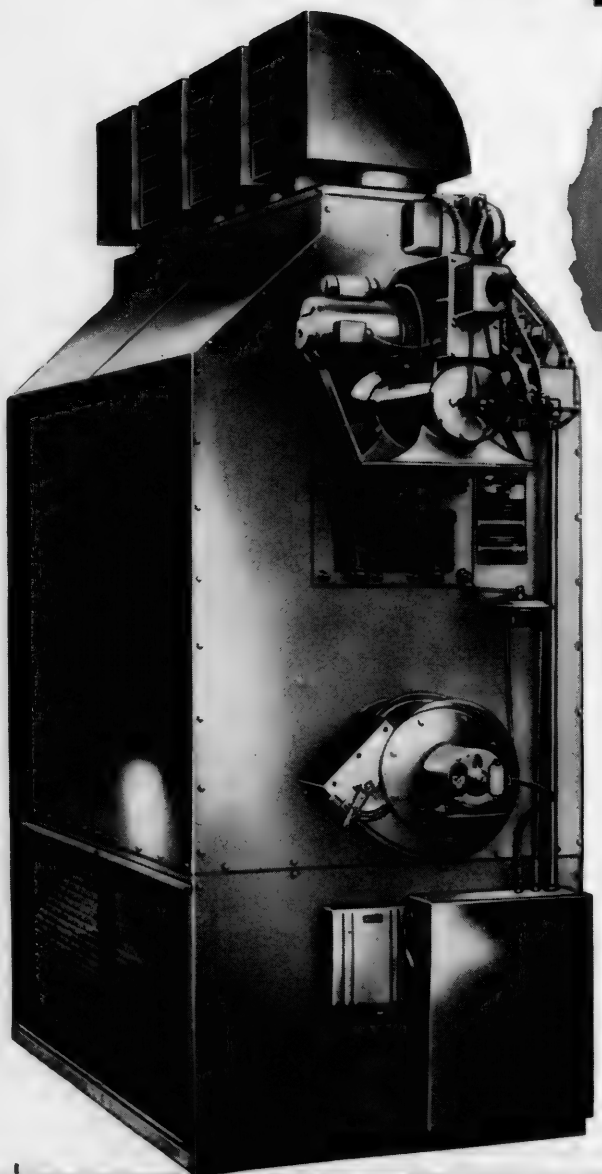
(d4)

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A., Canada and Mexico*

65 years of Automatic Temperature and Humidity Control

LENNOX TEAMWORK on call for every INDUSTRIAL HEATING



Thirty-seven LENNOX sales representatives team up with factory personnel in 10 strategically located LENNOX plants — to supply *any* type industrial heating equipment you might require.

Only LENNOX, world leader in warm air heating, can put sales application facilities like these at your beck and call — at a moment's notice. You may be assured that your nearby LENNOX sales representative is, himself, a qualified heating specialist. He is wholly familiar with the modern concept of industrial warm air heating and air conditioning which your plant requires. The added resources of factory consultation make him the best qualified heating man you can contact.

Whatever your heating problems (see facing page), the six different Lennox "AT" Industrial Heater models, in 8 capacities, can meet your exact requirements—with greater economy and efficiency. Direct fired heaters from 400,000 to 2,000,000 Btuh . . . using oil, gas or combination fuel.

MAIL THIS COUPON today for full engineering details on Lennox heavy-duty *4-pass counter flow design* and other exclusive design benefits.

LENNOX Industries Inc.

INDUSTRIAL DIVISION • 1701 East Euclid

— — Today

LENNOX INDUSTRIES INC.
Industrial Division, Dept. A-10
1701 East Euclid, Des Moines, Ia.

Please send me—without obligation—complete specifications and engineering data on Lennox AT series Industrial Heaters.

Name_____

Company_____

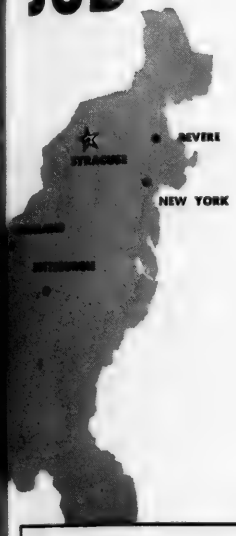
Address_____ City_____

Title_____

AIR CONDITIONING & HEATING

A typical "hot and cold" deck system of heating and air-conditioning uses a Lennox "AT" heat exchanger section in parallel with cooling coils to condition the atmosphere of this department store. Proportioning dampers and modulating burners on the "AT" units provide fuel economy and zone temperature control.

JOB



☆ Locates Lennox plants
● Locates Lennox sales representatives
(Canadian plants located at Toronto and Calgary.)

HEATING & VENTILATING

This food warehouse (with over 100,000 square feet of floor space, including a loading dock) is heated by five Lennox "AT" Industrial Heaters. Two of the heaters in the dock area blanket the loading doors with warm air, at the same time replacing the exhaust-laden atmosphere. Even temperatures are maintained throughout the building.

SPACE VENTILATION

One 2,000,000 Btuh Lennox "AT" Industrial Heater provides heating and ventilation for this large printing company. This single heater, equipped with modulating burner control and both fresh air and recirculating air dampers, provides economical heat and pure air for the printing area — where atmospheric conditions are vitally important to employees' health and productivity.

SPACE HEATING

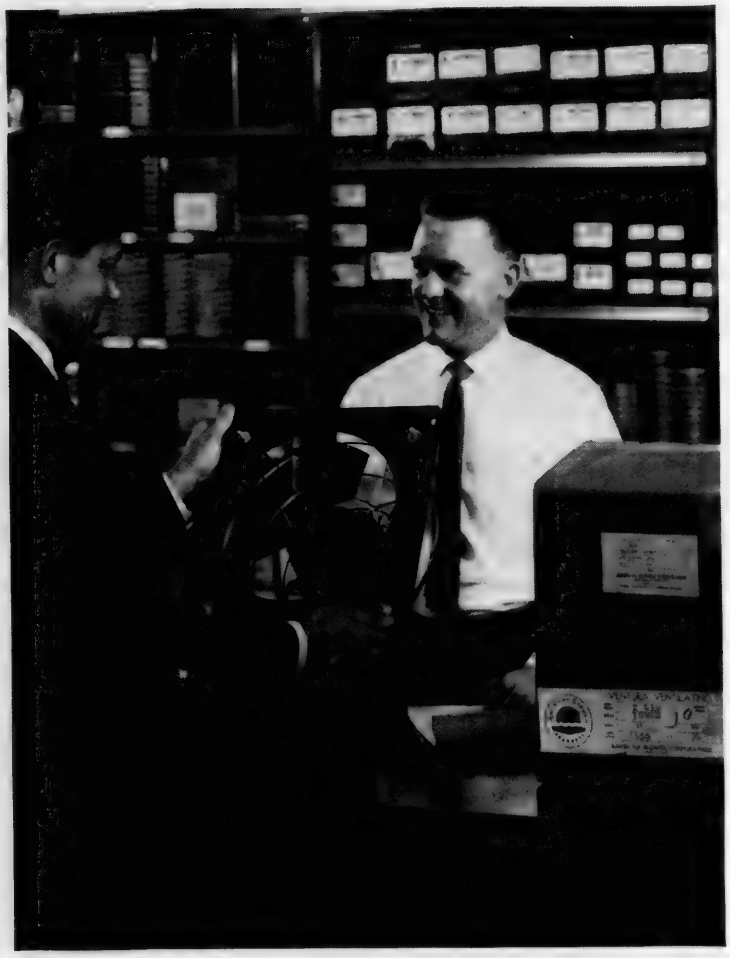
This steel warehouse with over 20,000 square feet of floor space is heated by two oil-burning Lennox "AT" Industrial heaters. Heated air is discharged at high velocity from directional nozzles above the heads of workers, providing a comfortable, even temperature in the working area, with minimum heat loss at ceiling level.

MAKE-UP AIR

A typical installation uses two "AT" 175-G gas-to-gas heaters for make-up air in this 20,000 square foot factory where numerous paint booths with exhaust fans remove large quantities of contaminated air. Modulating burners conserve fuel—while proportioning dampers permit recirculation and provide fresh air for comfortable working conditions. Units remotely located.

• *Des Moines, Ia.*

"Off-the-shelf" delivery



— another example of how you benefit when you select American Blower ventilating equipment

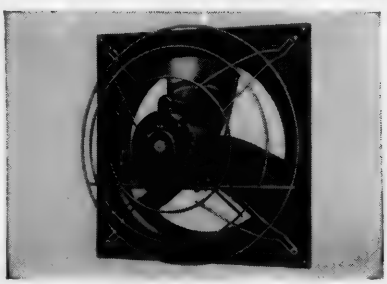
Efficiency-boosting ventilation practically sells itself; fast delivery *clinches* sales. So cash in now! Deliver quiet, efficient American Blower Ventura Fans "off-the-shelf" from *local* stocks, and watch profits increase!

Easy-to-install Ventura Fans move large volumes of air at low cost. They're designed to run quietly, and are competitively priced. Compact and attractive, Ventura Fans offer customers:

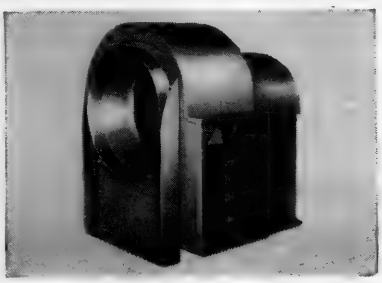
- **Packaged ventilation** – Complete, ready to use. Fast, economical installation.
- **Pre-engineering** – Each model handles a wide range of capacities. Just pick proper fan directly from the catalog. No on-the-job engineering needed.
- **Certified Ratings**—Air deliveries meet rigid standard test codes.

For *extra* profits, sell the *complete* line of American Blower fans for every ventilating job. Sales help: equipment selection assistance from one of our 73 branch offices. Write for facts today! American-Standard,* American Blower Division, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

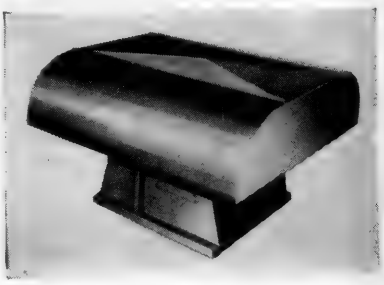
It pays to standardize on American Blower!



Ventura Fans – quiet, efficient, economical. Sizes from 10" to 30".



Utility Sets – direct drive, sizes 3" to 12¼"; V-belt drive, 9" to 36".



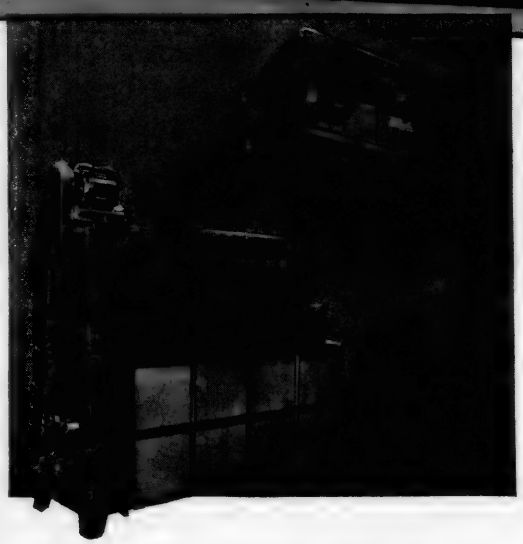
Power Roof Ventilators – available through American Blower branches.

* American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard
AMERICAN BLOWER DIVISION

a Monument to PERSHING
a Monument to AIR CONDITIONING
BY McQuay

Pershing Municipal Auditorium, Lincoln, Neb.
Architects: Davis & Wilson, Lincoln
Consulting Engineer: William Cassell, Kansas City, Mo.
Mechanical Contractors: Natkin & Co., Lincoln.



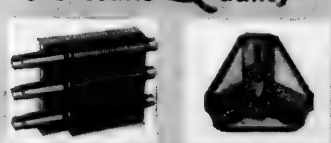
The Pershing Municipal Auditorium is a showplace in Lincoln, Nebraska. It is a monument to General Pershing and a monument to air conditioning. Thirteen McQuay Seasonmaster units and ten McQuay water coils provide year 'round air conditioning for this modern structure. To be sure that your next air conditioning job functions at its very best, see your McQuay representative. He will be glad to assist you in any air conditioning heating or refrigeration problems you may have. McQuay, Inc., 1619 Broadway Street N. E., Minneapolis 13, Minnesota.

McQuay Horizontal and Vertical Seasonmaster central station air conditioning units. They are available with water coils, steam coils or direct expansion coils. Removable panels permit complete accessibility for inspection or service. All Seasonmaster units are made with the exclusive McQuay Ripple-Fin coils. Seventeen sizes available. Range from 640 cfm to 38,000 cfm.

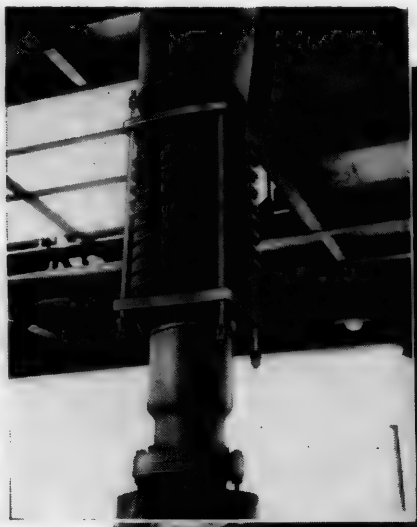
McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

McQuay Means Quality



McQuay units feature the exclusive Ripple Fin Coils which create maximum air turbulence and have wide, full fin collars that act as automatic spacers to form a tube around the coil tube for greatest heat transfer and protection. Dura-Frame "V" channel construction provides the strength and rigidity necessary for quiet, trouble-free operation.



ADSCO Corruflex Expansion Joint with #316 stainless steel element. From the position of the tie-rods, note the pipe movement the joint is absorbing.

In this section of the Houdriflow unit, there are 12 ADSCO Corruflex Expansion Joints with #316 stainless steel elements. Temperature here is 1100°F.

Houdriflow Catalytic Cracking Unit, Marcus Hook Refinery, Sun Oil Co.

LET THE PIPES SQUIRM . . .

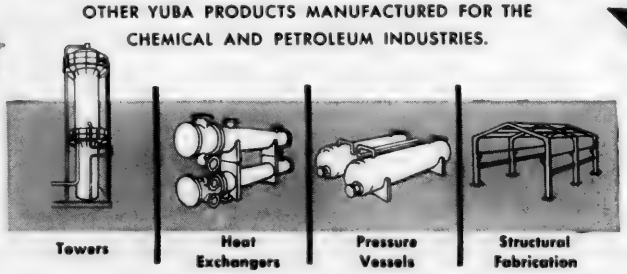
ADSCO

EXPANSION JOINTS ARE ON THE JOB!

Here, at the Marcus Hook Refinery of Sun Oil Co., temperatures run high. The piping naturally moves around a bit. But Sun engineers don't worry because they installed 62 Adsco Corruflex Expansion Joints to take the movement. Lateral offset, angular rotation, off-tackle slants... name it and Adsco Expansion Joints can absorb it. If you expect your pipes will get frisky, call our nearest sales-engineer, *or contact Adsco Division, Yuba Consolidated Industries, Inc., 20 Milburn St., Buffalo 12, N. Y.*

YUBA CONSOLIDATED INDUSTRIES, INC.

OTHER YUBA PRODUCTS MANUFACTURED FOR THE CHEMICAL AND PETROLEUM INDUSTRIES.



YUBA

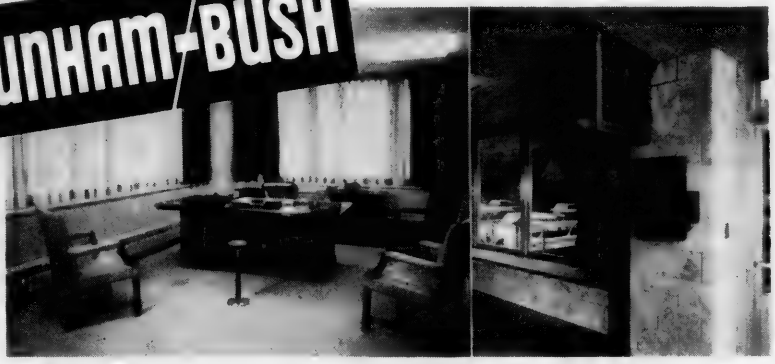
KNOWN

NESTLÉ's

for fine food products

New American Headquarters of The Nestlé Company, Inc., White Plains, N.Y.
Baseboard, steam specialties and unit heaters supplied by Dunham-Bush.

DUNHAM-BUSH



for dependable heating products

At Nestlé, good taste is packaged. At the heating specification level, good taste is Dunham-Bush. And more and more specifications include dependable Dunham-Bush heating, air-conditioning and refrigeration products for America's outstanding buildings.

Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER

WEST HARTFORD, CONNECTICUT • MICHIGAN CITY, INDIANA • MARSHALLTOWN IOWA
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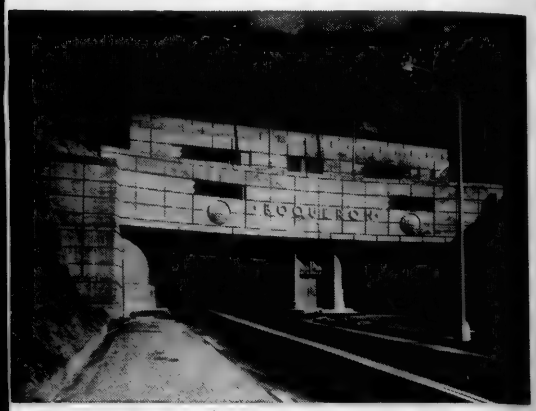
SUBSIDIARIES

heat-x HEAT-X, INC. GREWSTER, N.Y.
BRUNNER THE BRUNNER CO. GAINESVILLE, GA.
DUNHAM-BUSH (CANADA), LTD. TORONTO, CANADA
DUNHAM-BUSH, LTD. LONDON, ENGLAND
BRUNNER BRUNNER CORPORATION (CANADA) LTD. PORT HOPE, ONTARIO

The new Hampton Roads Tunnel uses 16 Joy Axivane Fans to move 3,406,000 cfm of both fresh and exhaust air.



Compact Joy installation at Boqueron, Venezuela, moves 3,952,000 cfm of air through a 1 mile tunnel.

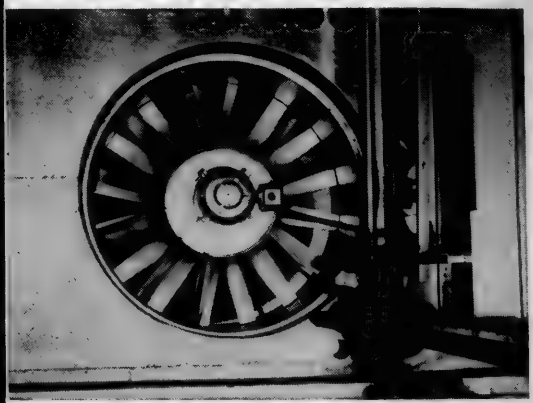
Ventilation Problems: JOY AXIVANE Handles the Hard Jobs

If you have a really tough ventilating job coming up . . . moving large volumes of air . . . variable pressures and volumes . . . unpredictable resistance . . . cramped space allotment . . . better take a look at the Joy Axivane Fans.

Compact design, with the motor *inside* the fan gives you more air per pound of fan and motor . . . more air per cubic foot of fan. The straight-thru design allows in-duct installation; becomes a *part* of the duct; eliminates offsets, elbows, drives and guards.

Pre-lubricated, double-shielded ball bearings permit the fan to be installed in *any* position. Adjustable blades allow for unpredictable resistance . . . permit changes in volume or pressure, *after* the fan is installed.

You choose from a standard line of over 136 models . . . and still have the advantage of Joy's custom engineering service. Joy Axivane Fans can make your next ventilating job a lot easier . . . one reason why Joy gets the tough assignments.



Joy Axivane design means power savings through adjust-in-motion blades at Alcoa's Texas Plant.

Dependable Joy installation circulates freezing air in California Cold Storage Plant.

WRITE FOR FREE BULLETIN 244-40

Get complete information about Joy Axivane Fans from **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

JOY SAVES YOU MONEY ON AIR

COMPRESSORS • FANS • DUST COLLECTORS

WBW I 7167-244

Every SPORLAN Solenoid Valve is POWER PACKED *with the famous*

Blue Seal Coil

...to give you

PEAK PERFORMANCE

on Every Installation

No matter what the refrigerant, or job size...whether it's a water, or hot gas application ... there's a Sporlan Solenoid Valve with the Famous Blue Seal Coil, that gives you that extra protection against burn outs, insulation and moisture failures, plus the time tested Sporlan design that makes Peak Performance a reality every time you install one!

So ... get the best, every time ... buy Sporlan Peak Performance Solenoid Valves for your very next job. They're Power Packed with the Famous Blue Seal Coil!

Include Sporlan Catch-Alls, See•Alls, Thermostatic Expansion Valves and Distributors with your Solenoid Valve order ...

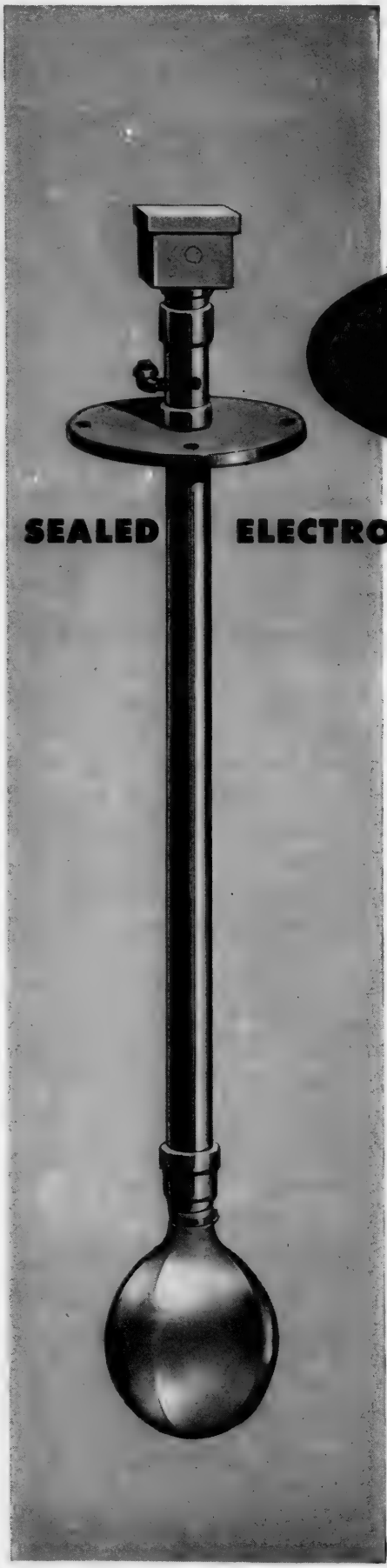
Get Peak Performance
Right Down the Line!

Your Sporlan Wholesaler has literature on all Sporlan Products... Be sure to ask him for Bulletin 30-10

SPORLAN VALVE COMPANY

7525 SUSSEX AVE. ST. LOUIS 17, MO.

EXPORT DEPT. 85 BROAD STREET, NEW YORK 4, N. Y.



"from Chicago"

sealtrode*

*A Trademark of Chicago Pump Company

SEALED ELECTRODE FLOATLESS PUMP CONTROLLER

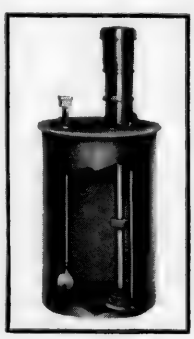
A new and valuable accessory for Sewage And Drainage Sump Pumps . . . exclusively available with "Chicago" Pumps.

The SEALTRODE* Sealed Electrode Floatless Pump Controller has every advantage of other floatless controllers, plus these advantages of being sealed:

- Electrodes never become insulated and coated with grease, oil or soap.
- Electrodes are never affected by corrosive elements in sewage and drainage water.
- No moving parts in liquid.
- Low original cost . . . eliminates need for dupiex float switches and float guide pipes.
- Low maintenance cost.

TYPICAL PUMP APPLICATIONS

SEWAGE PUMP **SUMP PUMP**



PATENT No. 2,797,702

Write direct, or contact Chicago Pump Company Distributors located in most principal cities, for bulletins and complete engineering data.

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

Chicago Pump Company

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Copyright 1958—Chicago Pump Company

In zero weather this warehouse was heated at a monthly cost of less than a penny per square foot

During last January's sub-zero weather, Dravo *Counterflo* heaters maintained a comfort-heat level of 68° in this 79,000 square foot warehouse—and at a fuel cost of only seven-tenths of a cent per square foot for the month.

Recently erected for C. A. Turner Inc., Rankin, Pa., the insulated industrial supply warehouse, with high roof areas and large access doors for truck and rail shipments, is heated by just three 500,000 Btu/hr and one 750,000 Btu/hr gas-fired heaters.

The Dravo "blanket-of-air" method of circulation is particularly effective in large, hard-to-heat areas. Based on high velocity discharge of warm air above the working zone and low velocity return at floor level, this system reduces heat-loss to the roof. Warm air is pulled down to the work area by the return of cool air to the heater. A Dravo heating engineer will be glad to explain the application of this money-saving principle to your particular heating problem.

Bulletin 564, describing the complete line of Dravo *Counterflo* heaters, is available. Write Dravo Corporation, Dravo Building, Pittsburgh 22, Pa.

DRAVO
CORPORATION

Blast furnace blowers • boiler and power plants • bridge sub-structures • cab conditioners • docks and unloaders • dredging • fabricated piping foundations • gantry and floating cranes • gas and oil pumping stations • locks and dams • ore and coal bridges • process equipment • pumphouses and intakes • river sand and gravel • sintering plants • slopes, shafts, tunnels • space heaters • steel grating • towboats, barges, river transportation

TRADE FRICK MARK®

Air Conditioning & Refrigeration

Serving the Great BARNES HOSPITAL . . . WASHINGTON UNIV. MEDICAL CENTER at St. Louis, Mo.

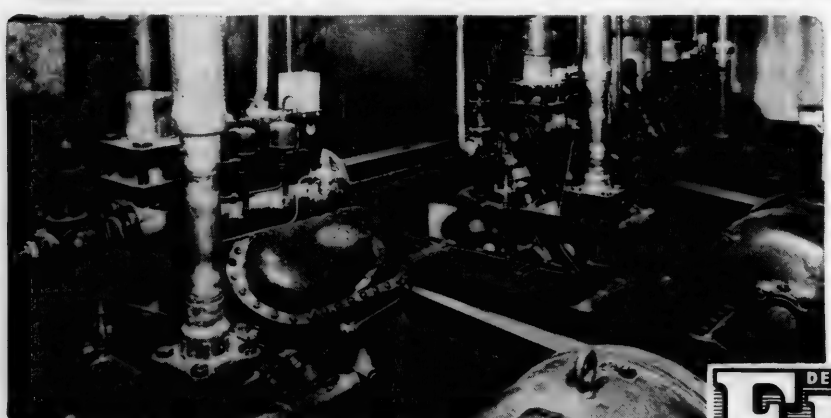
7½-Ton Frick unit air conditioner serving four research and lecture rooms.

Here 11 Frick unit air conditioners and 42 Frick compressors supply the necessary cooling services for operating rooms, private rooms, auditorium and chapel, class rooms, nurse-interns' dormitories, offices, libraries, laboratories, cafeterias, kitchens, special freezers, research departments, morgues, animal rooms, etc. Installation by L. V. Fleiter Co., Inc., Frick Distributors in St. Louis, Missouri.

Whether you need conditioned air, cold water, ice, cold rooms, or very low temperatures,—for human comfort, food service, process work, quick freezing, research, or any other commercial or industrial purpose,—there's a Frick system to meet your exact requirements.

Let us quote now on the equipment you need.

Write . . .
wire . . . phone or visit.



Three Frick "ECLIPSE" compressors which air condition several operating rooms at Barnes Hospital, St. Louis.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA., U. S. A.

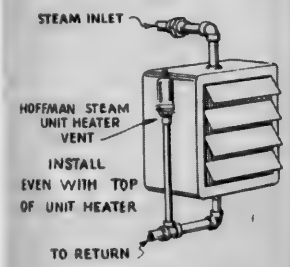
FOR MAXIMUM EFFICIENCY

USE HOFFMAN VENTS

To get top performance on Steam Unit Heaters, Steam Heating Systems, Steam Process Work, Hot Water Heating Systems, Domestic Water, Summer-Winter Units—Water Process work, air must be eliminated. Hoffman Vents are designed to vent the air accumulations so that the equipment will function effectively.

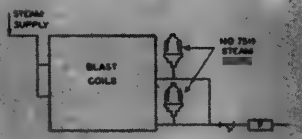
Installation of these vents now on old or new jobs will insure the maximum efficiency of the equipment.

NO. 74 VENT FOR STEAM UNIT HEATERS



To insure best results, Steam Unit Heaters must be "piping hot." The No. 74 vent is a float type vent especially designed for use with Steam Unit Heaters. This vent will expel the air as it accumulates.

Size Connection: ¾" male, ½" female. Maximum Operating Pressure: 35 P. S. I.

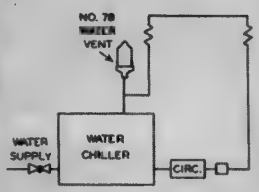


NO. 75 H STEAM VENT

An air vent for systems, supplied with steam from constant source such as District Heating, Pressure Reducing Stations and Zoned Systems.

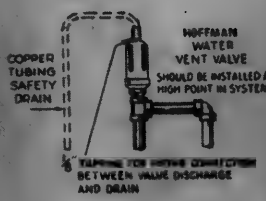
Size Connection: ¾" male, ½" female. Venting Pressure: 10 P. S. I. System Pressure: 15 P. S. I.

NO. 78 HIGH PRESSURE WATER VENT

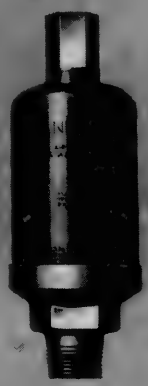


Designed for use on high pressure hot or cold water mains and process applications. Cast brass body. Safety drain connection for discharging moisture entrained in the vented air. Has drain tube fitting and ferrule for ¼" O.D. tubing.

Size Connection: ¾" male, ½" female. Maximum Operating Pressure: 150 P. S. I.—will withstand hydrostatic pressures of 450 P. S. I.


COPPER TUBING SAFETY DRAIN
HOFFMAN WATER VENT VALVE
SHOULD BE INSTALLED AT HIGH POINT IN SYSTEM
BETWEEN VALVE DISCHARGE AND DRAIN

NO. 79 WATER VENT



For good circulation on any water system (hot or cold) it is necessary to let the air out. The No. 79 vent is designed for use on hot or cold water mains and process applications. Tapped at top for ⅛" I. P. S. safety drain connection for discharging moisture entrained in the vented air.

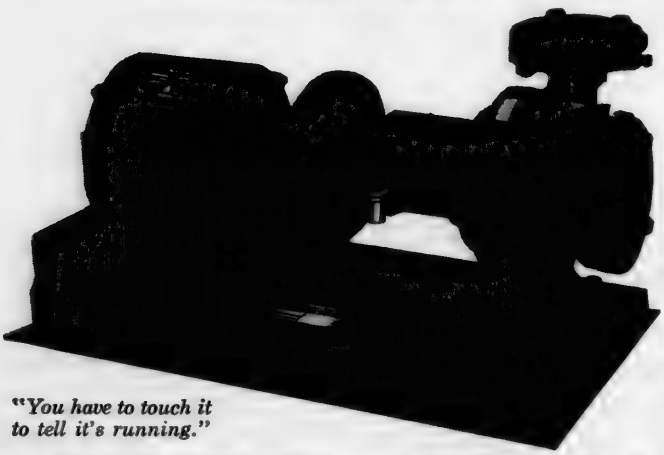
Size Connection: ¾" male, ½" female. Maximum Operating Pressure: 75 P. S. I.

HOFFMAN SPECIALTY MFG. CORP.

1700 W. 10th Street, Indianapolis 7, Indiana

Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems, stocked and sold by leading Wholesalers of Heating and Plumbing Equipment

EIGHTEEN B&G UNIVERSAL PUMPS DELIVER Quiet HEAT



"You have to touch it to tell it's running."

Parkview High School, Springfield, Mo.

Architect: Richard P. Stahl, Springfield, Mo.
Engineer: R. W. Bare, Springfield, Mo.
Contractor: McCarty Co., Springfield, Mo.

Selecting a pump for a circulated water heating or cooling system is not merely a matter of proper head and capacity. *Quiet, vibrationless operation is of major importance!*

In the modern school shown here, eighteen B&G Universal Pumps deliver heat without distracting noise. These pumps are designed specifically for heating system use... built to perform dependably and *silently*. No vibration eliminators or flexible connections to the piping are needed.

Universal Pump motors, for example, are specially constructed and selected for *extra-quiet* operation. Long *sleeve* bearings are used in both motor and pump—another assurance of smooth, vibrationless operation and long life of both pump and motor. The oversized shaft is made of special alloy steel with an integral, heat-treated thrust collar to absorb end-thrust. Water leakage is prevented by the diamond-hard "Remite" mechanical seal...a B&G development.

Note, too, that *vertical* split case construction with removable bearing frame permits easy servicing without breaking pipe connections or motor leads.

B&G BOOSTER

An in-line pump of smaller capacities than the B&G Universal, but with the same features which assure quiet operation.

BELL & GOSSETT
COMPANY

Dept. FL-4, Morton Grove, Illinois

Reg. U.S. Pat. Off.

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

Top heating performance by RECO atop the mile high city!

IRST NATIONAL BANK BUILDING Denver, Colo.*

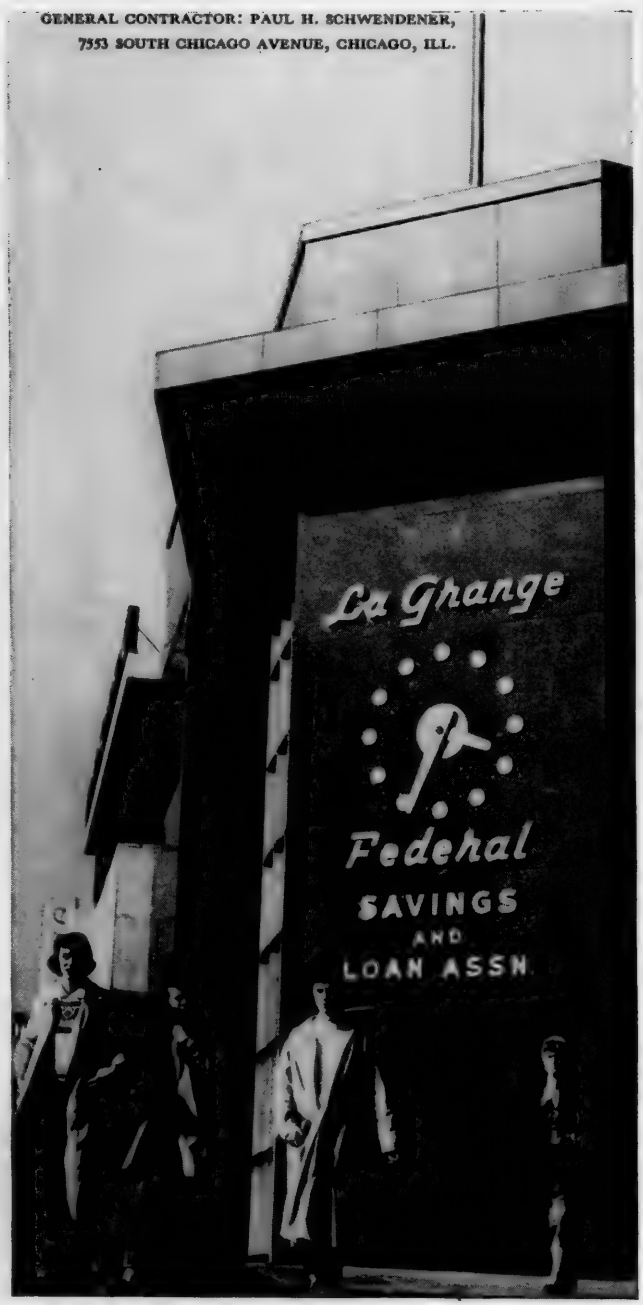
Going up! This seven-ton RECO tank recently climbed 28 stories to a permanent spot on top of Denver's First National Bank Building. Now it is there to stay. This copper-lined hydropneumatic storage tank is typical of all RECO engineered products — including the copper-silicon generators, pressure tanks, and heaters which were installed at First National in less spectacular fashion.

RECO offers you a complete line of heat exchange equipment. All equipment is ASME inspected and insured. Special linings are available . . . all standard metals and alloys are used. Our engineers are at your service. Call or write for free 20-page storage heater catalog containing tables, dimensions, diagrams and details. *Address RECO, Dept. B, 7th & Hospital Sts., Richmond 5, Va.*

CONVERTORS STORAGE HEATERS INSTANTANEOUS HEATERS HEAT RECLAIMERS STORAGE TANKS

RICHMOND ENGINEERING CO., INC.

...now we're cooling



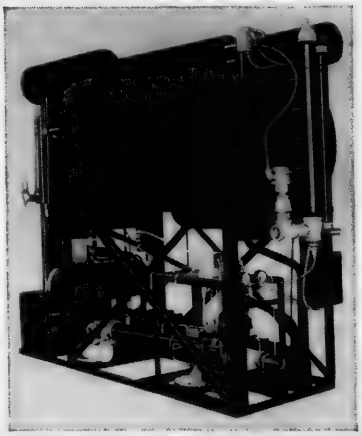
GENERAL CONTRACTOR: PAUL H. SCHWENDENER, 7553 SOUTH CHICAGO AVENUE, CHICAGO, ILL.

Specify Arkla-Servel Gas Air

With their new Arkla-Servel Gas Absorptive Cooler, the La Grange Federal Savings and Loan Association keeps customers cool in summer with the same compact system that keeps them warm in winter.

Before installing Gas, a complete study was made of available air conditioning systems. The Arkla-Servel unit—the only 25-ton absorptive cooler—was chosen because it is compact, easy to install, and costs are low for installation, operation and maintenance. No specially trained operating or maintenance personnel are required.

with GAS



Conditioning and you specify years of trouble-free comfort

Only Gas gives these important advantages:

- high efficiency at all times—even during the light loads
- temperature control is constant
- modular adjustment of capacity (instant automatic adjustment to match actual cooling requirements)
- dependability of fuel service at all times

Gas absorptive cooling can put your commercial and industrial clients' heating plant on a year around paying basis. It utilizes low pressure steam to cool water, has no moving parts to wear out, and provides quiet, economical operation. What's more, it's vibration-free.

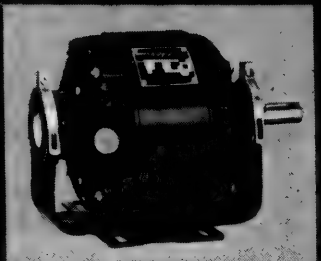
Take advantage of the consulting services provided by your Gas company. They have trained specialists who have been working with contractors and builders for years. They belong to your associations or affiliations and are familiar with your problems. Check the facts about Gas and you'll see modern Gas air conditioning out-performs all other fuels. *American Gas Association.*

Here Precision Counts...

A fine racing car must be *precision-designed* and *precision-built* as must the motors for your appliance or equipment applications. At Emerson-Electric, you get the benefits of more than 65 years of experience in solving motor-drive problems— plus unique production facilities that produce *in volume* the precision motor specifically designed for *you*.

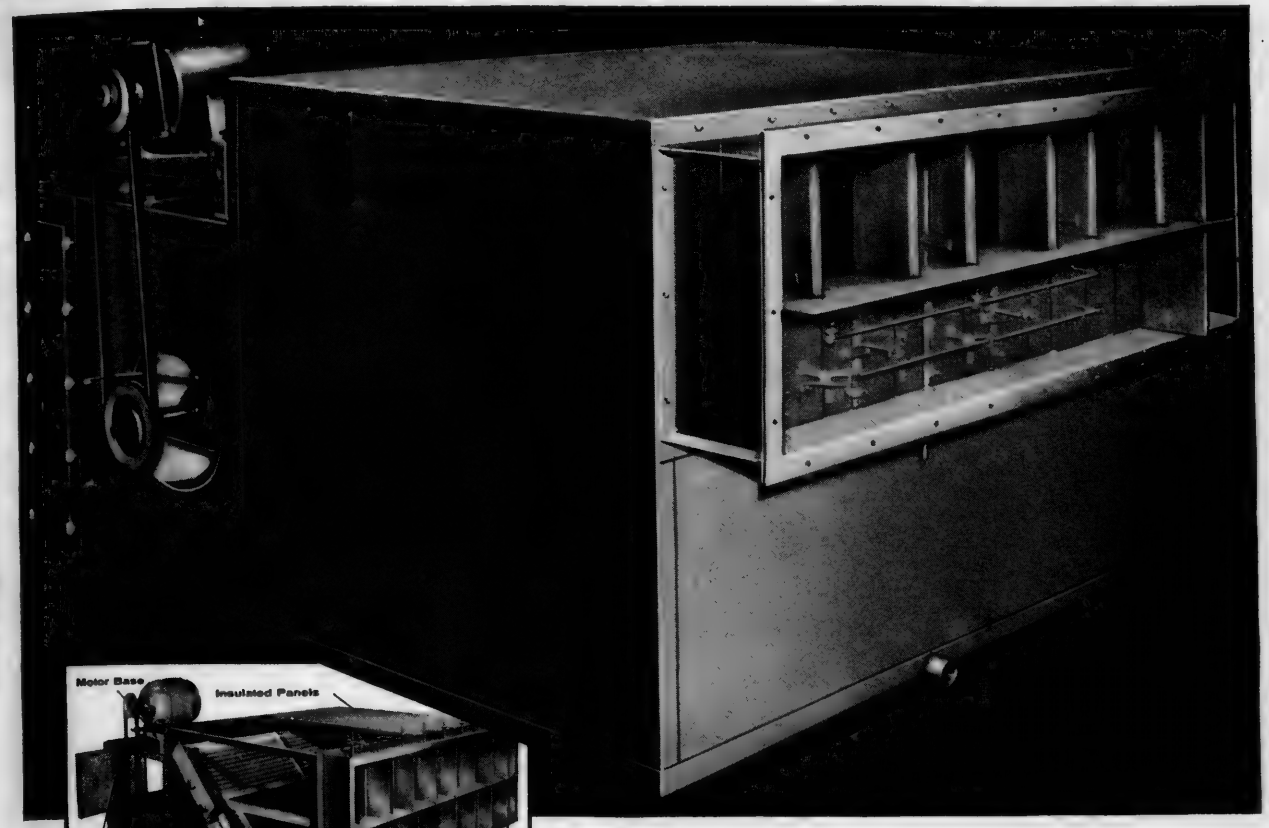
Remember:

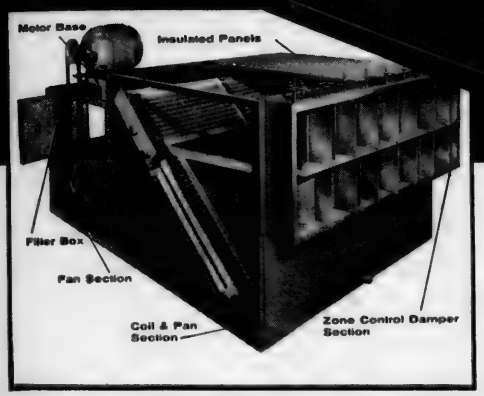
- Emerson-Electric has more than 100 skilled engineers ready to offer you on-the-spot service from design right on through application tests.
- Emerson-Electric produces *custom-engineered* motors to suit *your specific needs.*



To solve your motor-drive problems with precision, call, wire or write Dept. M-323 today. The Emerson Electric Mfg. Co., St. Louis 21, Mo.

EMERSON-ELECTRIC *of St. Louis • Since 1890*





ACCURATE TEMPERATURE CONTROL PROVIDED BY "BUFFALO" ZONE CONTROL CABINETS

"Buffalo" Zone Control Cabinets are engineered for installations where a single unit must provide varying degrees of conditioned air for several zones or rooms. These quiet operating compact units perform with peak economy, flexibility and dependability.

Temperature is controlled by mixing cooled and heated air in just the right proportions to suit each conditioned space. The need for separate re-heat coils and their controls is completely eliminated. Control for each area can be manual or entirely automatic.

"Buffalo" Zone Control Cabinets are sectionalized for maximum ease of installation. Removable panels and bearings located outside the cabinet simplify servicing. The entire unit is sturdily constructed to insure a long life of maintenance-free operation.

You're sure of satisfactory results when you specify "Buffalo" Zone Control Cabinets. Your "Buffalo" engineering representative will be pleased to provide you with information concerning unit selection, installation, etc. Contact him, or write us direct for Bulletin AC-220.

All "Buffalo" equipment brings you the "Q" Factor — the built-in QUALITY which provides trouble-free satisfaction and long life.

BUFFALO FORGE COMPANY

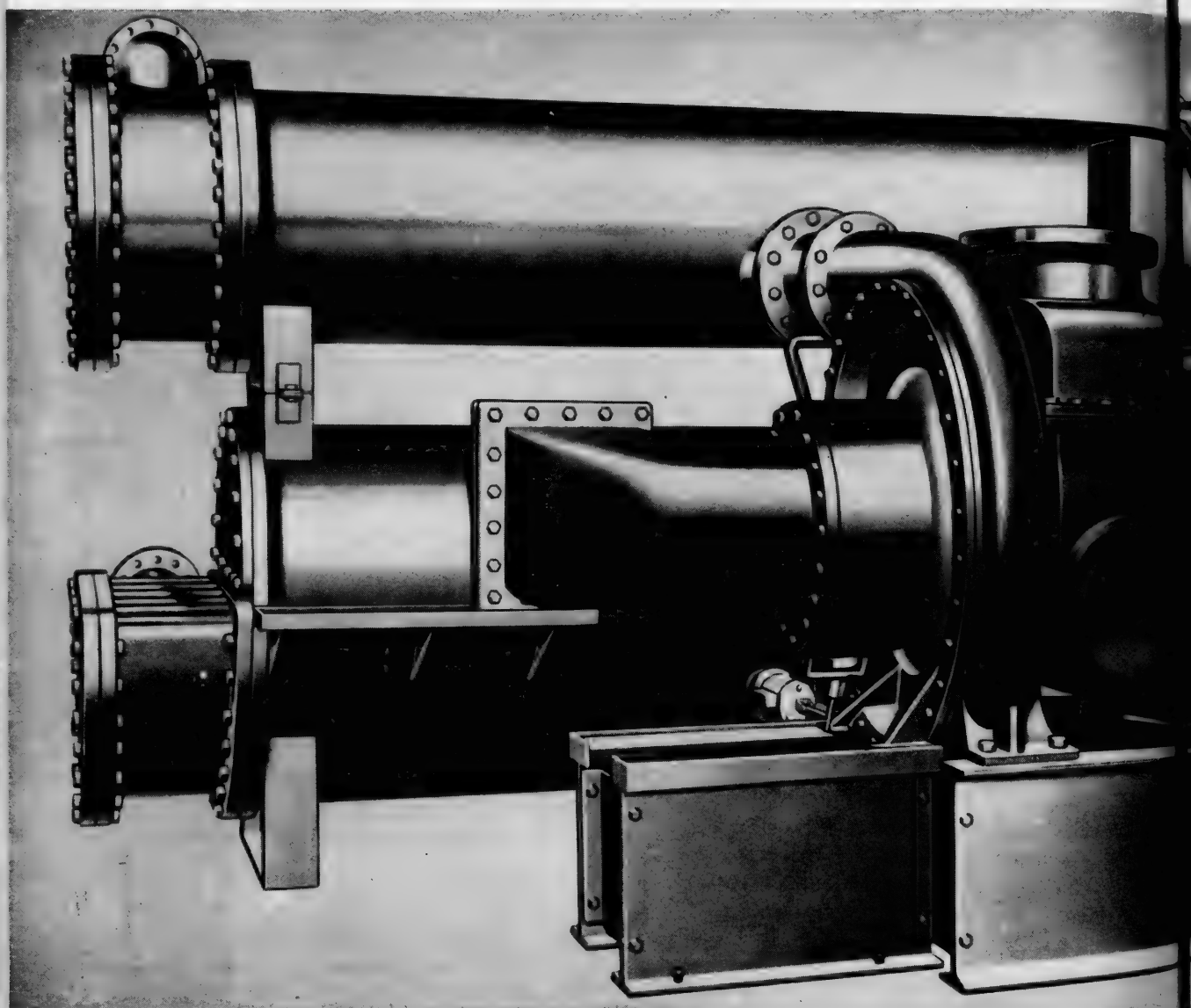
BUFFALO, NEW YORK

Buffalo Pumps Division • Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

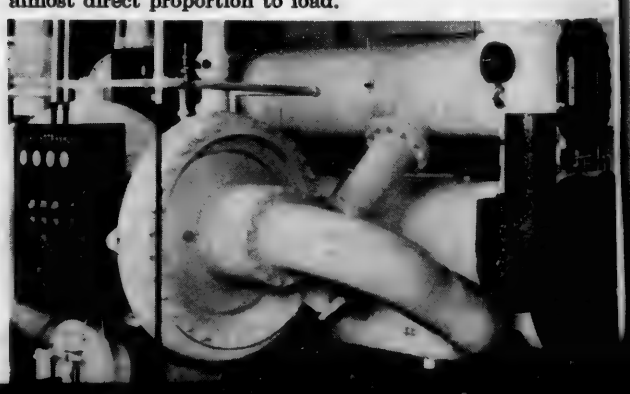
VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING
FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

TRANE ANNOUNCES
with

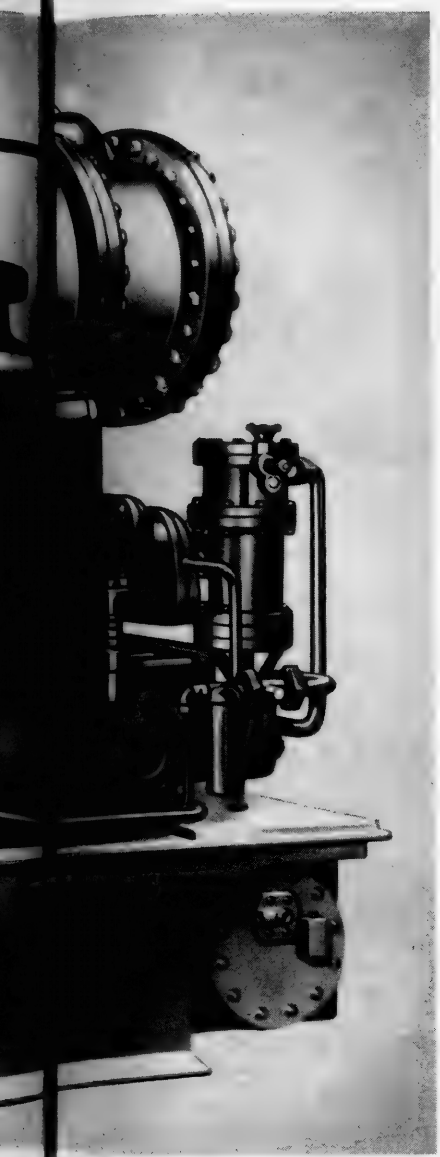


The Turbine CenTraVac reduces refrigeration costs to a minimum . . . brings new savings to plants and buildings where steam is available. Constant speed operation with prerotation vane capacity control improves performance at all part-load conditions. Compressor and turbine factory-assembled on a common base to eliminate field alignment problems. 300 to 1600 tons.

Hermetic CenTraVac water chiller with electric drive has been specified for more installations than all other makes combined! Modulates to 10% of capacity or lower, with power savings in almost direct proportion to load.



A CenTraVac® steam turbine drive



Now! Lower steam refrigeration costs, simplified installation with th Turbine CenTraVac—300 to 1600-ton water chillers.

Here's the first major advance in twenty years in the field of turbine refrigera tion equipment! It's the TRANE Turbine CenTraVac, a centrifugal wate chiller that combines the efficient CenTraVac compressor design with steam turbine drive—plus advantages not found in other turbine refrigeration unit

- **More efficient design.** Fewer moving parts. Impeller mounted on extended turbine shaft eliminates thrust and journal bearings.
- **Simplified installation.** Integral assembly of compressor and turbine eliminates critical field alignment problems.
- **Superior seal design.** Only ring collar of shaft seal rotates. Positive separation of oil and refrigerant.

Next time you plan an air conditioning system, consider the dependable TRAN Turbine CenTraVac. It's a complete water chilling system, simple in desig simple to install, quiet and vibration-free. It may be installed on any lev surface, with no special bases. Wherever there is a supply of steam, it wi provide new economy—with all the traditional quality and dependability the hermetic CenTraVac.

Want more facts? Call your nearby TRANE Sales Office, or write TRANE La Crosse, Wisconsin.

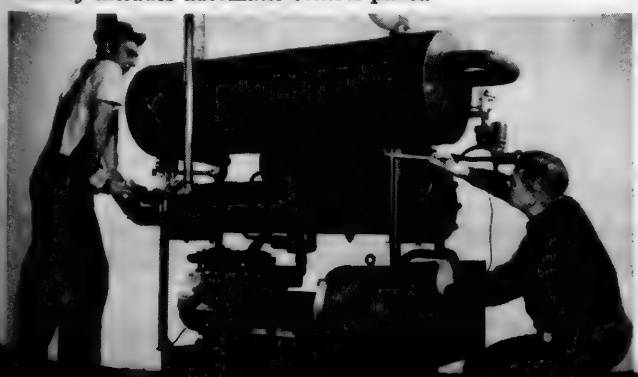
For any air condition, turn to

TRANE

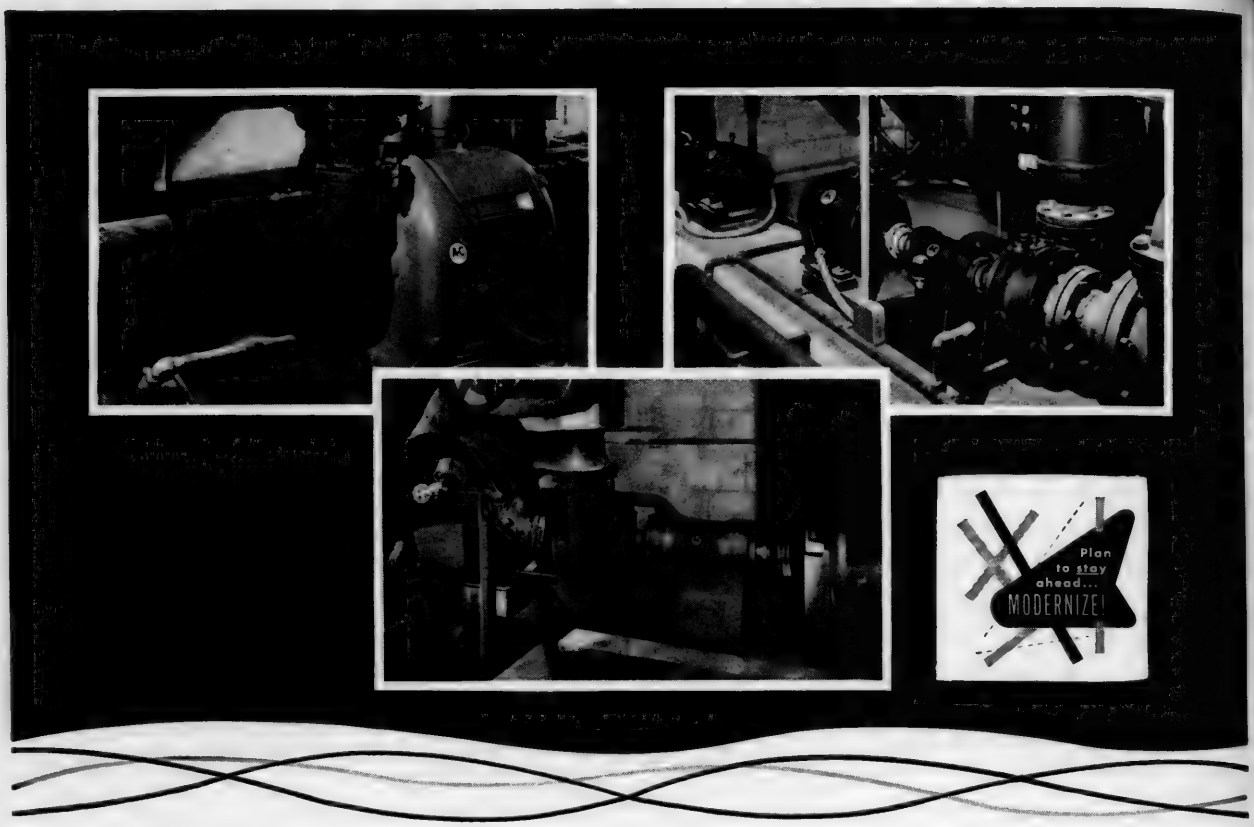
MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. • CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 97 U.S. AND 19 CANADIAN OFFICES

For smaller jobs, the TRANE Cold Generator gives you a packaged water chiller in sizes from 10 to 150 tons. 4-step compressor modulation cuts power consumption. Factory pre-assembly includes automatic control panel.



Individually controlled UniTrane units filter all the air. Fan-coil and induction units available for floor, ceiling and concealed installation. New low-silhouette induction unit (illustrated) fits under low windows.



for 99% of all air-conditioning applications...

there's a RIGHT Allis-Chalmers PUMP

TYPICAL of Allis-Chalmers pump line is this model with variations in both fractional and integral horsepower sizes. All close-coupled models have only two base sizes for the entire range.

WHATEVER the air-conditioning application, there's sure to be the correct Allis-Chalmers pump for the job. The reason: A-C pumps are assembled for *your* application from standard components. This is truly "standardized specialization" — tailored pumps at a mass-production price.

Close-coupled, horizontal, sidewall-mounted and submersible models are all available with a wide choice of mounting methods. Whatever type of conditioning equipment is involved — small and medium-sized tanks, absorption and centrifugal machines; cooling towers, plus other systems — A-C has *the* pump. Capacities to 3200 gpm, heads to 400 feet.

For the pumps you need, contact your A-C representative, distributor or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

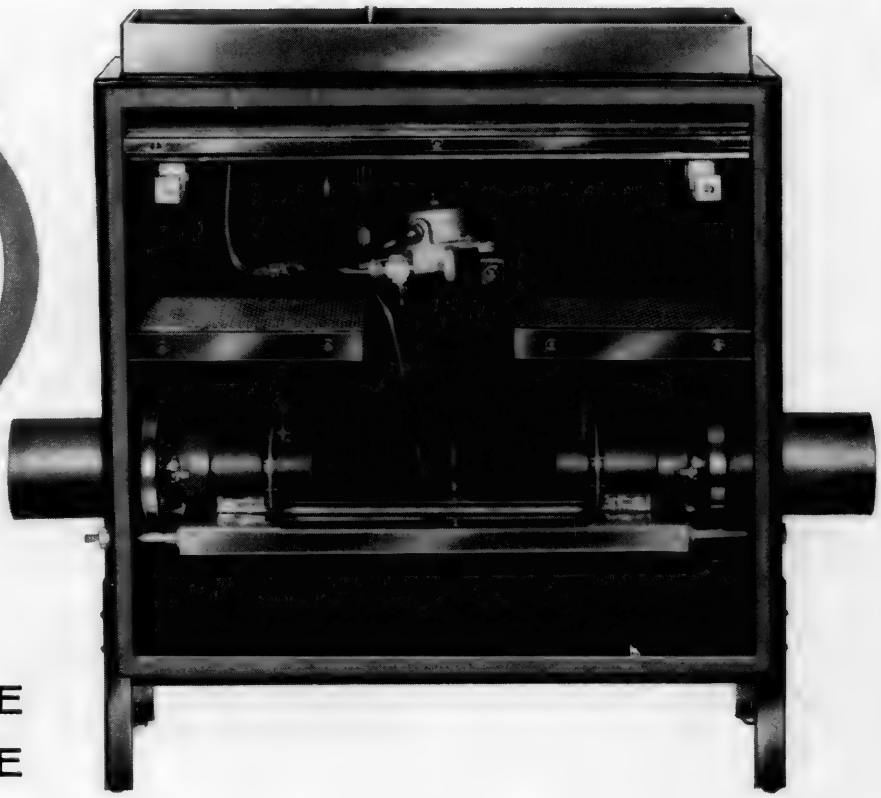
A-5635

NEW

THERMOTANK — AGITAIR

CON-VOL EQUIPPED HIGH VELOCITY UNITS

CONSTANT VOLUME UNDER ALL CONDITIONS



EXCLUSIVE FEATURE ASSURES PRECISION CONTROL OF AIR VOLUME AND TEMPERATURE

The new Thermotank Con-Vol Unit delivers constant air volume over a wide range of varying inlet pressures. Instant response and positive valve closure are obtained due to the complete absence of linkage or complicated operating mechanism. Both the hot and the cold valves are regulated by the flow controller as conditions demand. An access door permits inspection of all moving parts and easy removal of valves and controls. For more information on Con-Vol equipped units ask your Thermotank-Agitair representative or write direct to Air Devices Inc.

THERMOTANK — AGITAIR

high velocity units • punkah louvers
air diffusers • filters • exhausters
registers and grilles

Sold exclusively by representatives for:

AIR DEVICES INC. • 185 MADISON AVENUE, NEW YORK 16, N.Y.

" to make it easier to select and install

ALLENCO now offers this unique reference...

Checkbook has been prepared in response to many inquiries. It is a concise "pattern" or "key" for relating the wide range of fire protection factors. It is *not* a catalog.* For men who are not directly working on this part of construction, it helps maintain supervisory know-how.

Checkbook helps interpret and implement authorities' requirements... select and place equipment...avoid waste of space, time, cost...best serve designed appearance, occupant's use and safety.

*see Sweet's or Domestic Engineering catalog directory, Allenco catalog 150 (A.I.A. file 29e2) or new products data

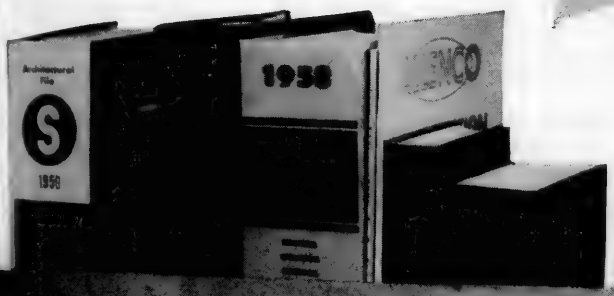
re Protection equipment..."

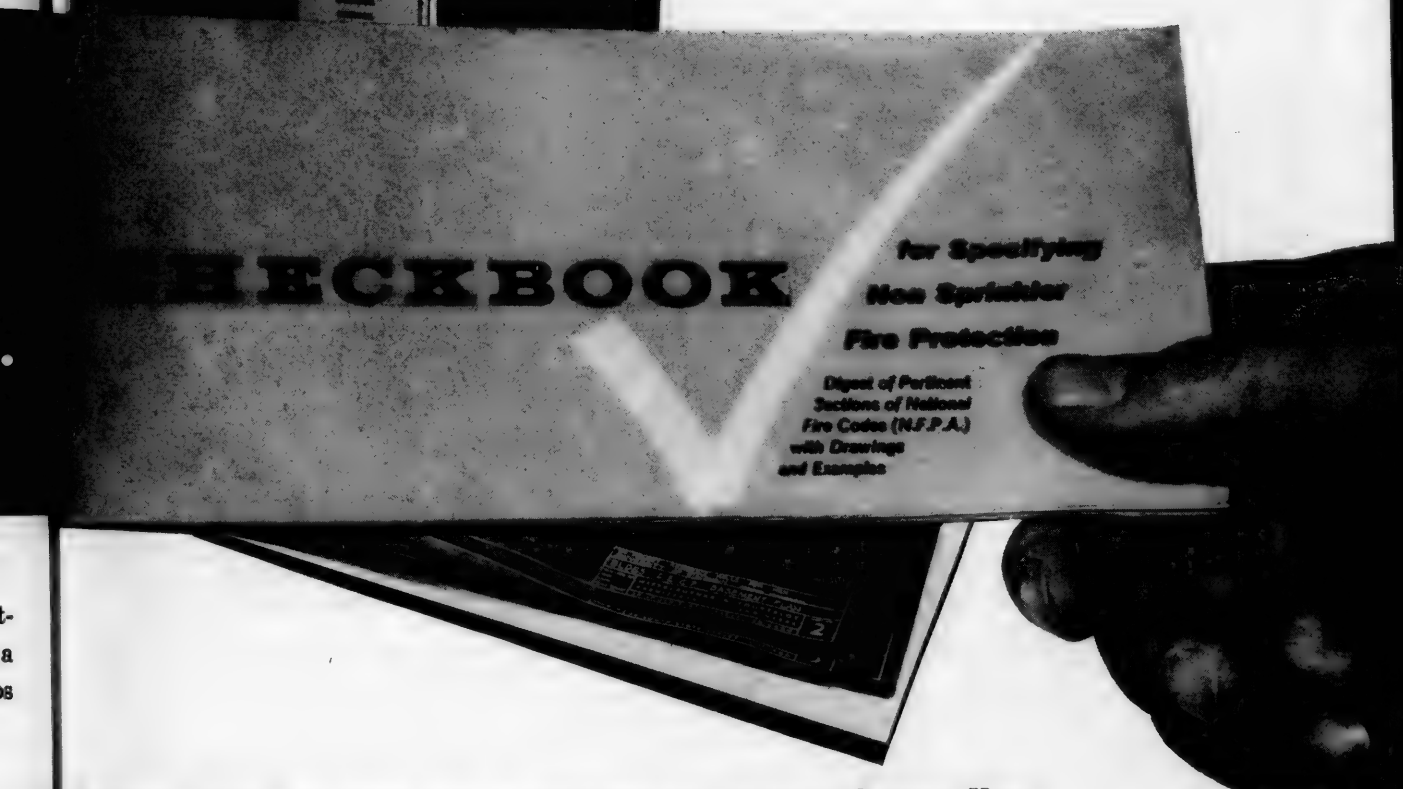
11.2 FIRE EXTINGUISHERS AND CABINETS:

Contractor shall provide and install the foll... extinguishers and cabinets comple..., as ma... W. D. Allen Manufacturing Co., (Allenco) or ...equal. Extinguishers shall be filled and ready for use.

A. Fire Extinguisher Cabinets: 8 (eight) required, one at each fire alarm station. Installed as detailed, unit #285 12" x 27" x 3" cabinet complete with Allenco aluminum door and trim, glazed with single strength glass, and fitush fitted flat key cylinder lock.

else!





Checkbook reports and shows basic requirements for:—Standpipe Systems; Hose Stations; Extinguishers; Exterior Centers. It includes "coupon specifications" forms for major items, which may simply be removed and filled-in for easier spec-writing. It also lists references for details digested here.

Checkbook is unique, practical, valuable. Your copy will be sent on request. Write or phone your Allenco Fieldman (listed in Yellow Pages) or direct to home office.

ALLENCO *Since 1887*

W. D. ALLEN Manufacturing Co.

Room 500 Allenco Bldg. 566 W. Lake St. Chicago 6

A complete line of OIL BOILER-BURNER UNITS BY WEIL-McLAIN

MEMBER I=B=R

TESTED AND RATED

PRESENTING NEW AND EXCLUSIVE DESIGNS FOR HIGHER EFFICIENCY...GREATER DEPENDABILITY...AND LONGER LIFE

Weil-McLain now offers a single source of supply for oil heating units in net capacities from 68,000 to 2,709,600 BTU/hr. These are boilers designed specifically for oil-firing, with many exclusive features which assure dependable operation and fuel economy. The burner and other components *are engineered and integrated to function as a unit;* so that the basic requirements of efficient oil-firing are fully satisfied.

All Weil-McLain Oil Boiler-Burner Units are I=B=R tested and rated...your assurance that they will deliver performance as published. These units are also available as oil-fired boilers.

Weil-McLain Boilers are also distinguished by numerous features which contribute to long, trouble-free life.

Built of corrosion-resistant cast iron, assembled with multiple short draw rods and made gas-tight with new asbestos rope seal, they can be rapidly erected in a strain-free assembly.

Let us send you these catalogs on Weil-McLain Oil Boiler-Burner Units for residences, commercial and industrial buildings.

WEIL-McLAIN BOILERS RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

Address literature requests to Dept. BB-108

Sarco Type H Radiator Trap

Sarco Spring-Packless Steam Radiator Valve

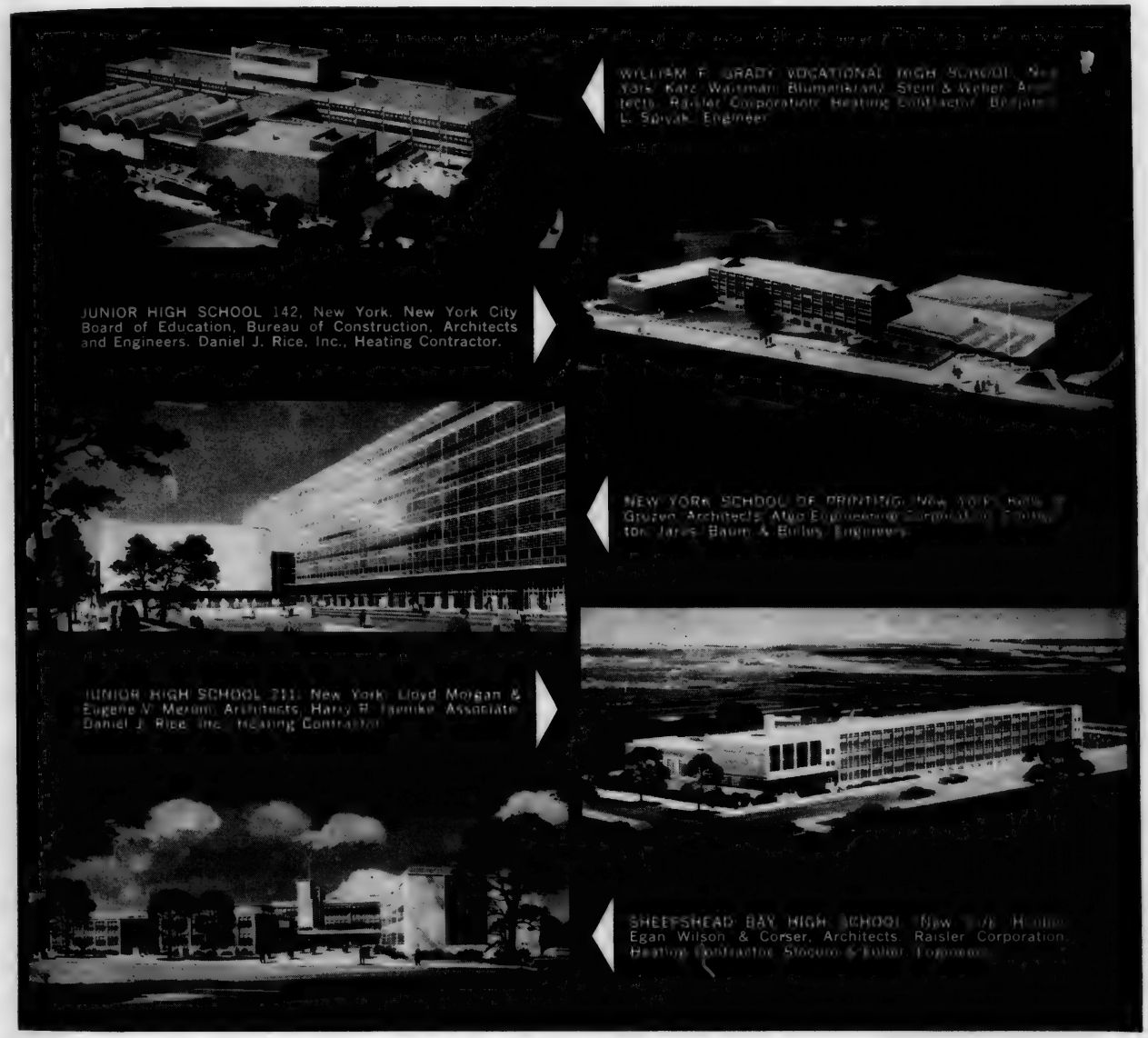
Sarco Float-Thermostatic Steam Trap

Sarco SB Strainer

Sarco TR 50-21 Temperature Regulator

These Sarco Products

give these New York City Schools reliable heating systems . . . economically



JUNIOR HIGH SCHOOL 142, New York. New York City Board of Education, Bureau of Construction, Architects and Engineers. Daniel J. Rice, Inc., Heating Contractor.

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In all five of these brand new schools, designed and constructed to the highest standards of the New York City Board of Education, all five of these Sarco products shown above are used to assure trouble-free heating systems. High-quality Sarco steam traps, valves, strainers, temperature controls, and other heating specialties assure dependable system performance — with extremely low maintenance costs.

FOR DETAILS on cost-saving temperature controls, steam traps, or heating specialties . . . or for engineering information . . . contact your Sarco-Sarcotherm sales representative, or write

6692-B

SARCO
COMPANY, INC.

635 Madison Ave., New York 22, N. Y.

STEAM TRAPS • TEMPERATURE CONTROLLERS • STRAINERS • HEATING SPECIALTIES

THE MARK OF QUALITY

BARBER COLMAN

You can guarantee

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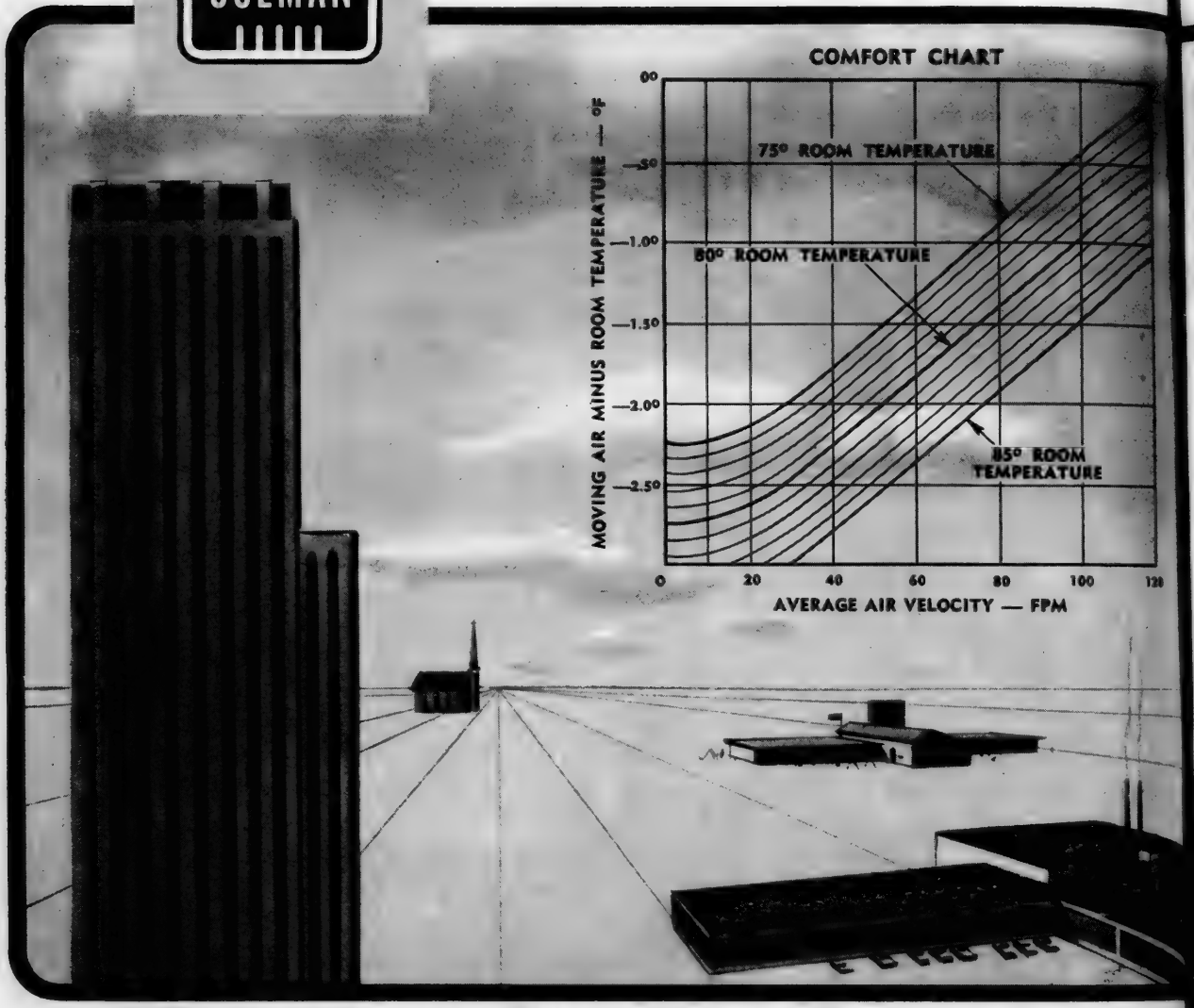
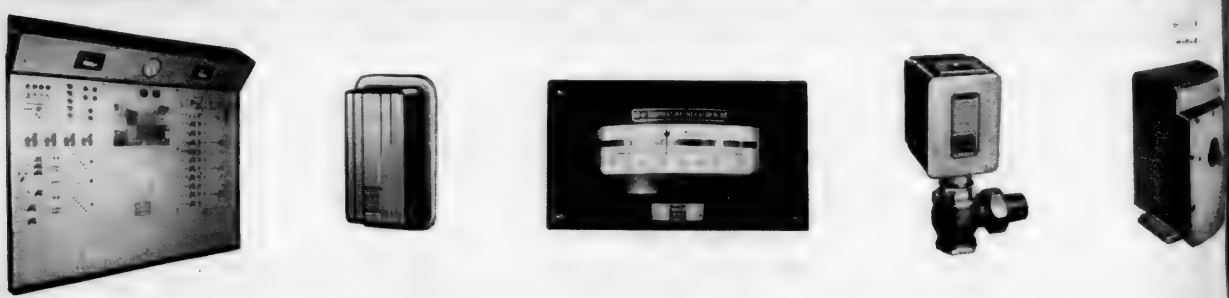


ELECTRIONIC AUTOMATIC CONTROLS...

A complete line of automatic controls for air conditioning, heating, and ventilating servic



ONE SOURCE...UNDIVIDED RESPONSIBILITY...

every air conditioning job conform to this comfort chart*

*When you combine Electronic Automatic Controls with Uni-Flo Engineered Air Distribution

It is impossible to provide uniformly comfortable air conditioning without the correct correlation between air movement and room temperature. When occupants complain that a room is alternately too warm, too cool, or too drafty, you can be sure that the correct relationship between air distribution and temperature control has not been met.

The importance of this relationship cannot be overemphasized because an individual's comfort is affected by:

1. **Room temperature.**
2. **Velocity of conditioned air being introduced to the room.**
3. **Temperature of moving air in relation to average air temperature in the room.**

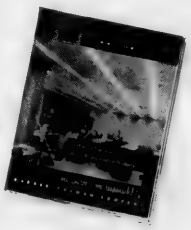
The scientifically correct relationship is plotted on the Barber-Colman Comfort Chart shown at the left. This requires closely coordinated functioning of the system's automatic controls and its air distribution units.

Failure to meet the Comfort Chart requirements is the cause of complaints and costs long after the job is "done." This is the point at which it is difficult to establish responsibility for the faults in the system.

When Barber-Colman Electrionic controls and Uni-Flo engineered air distribution are combined on your job, you have complete assurance that the system will function correctly, providing constant comfort to the occupants of the building at all times. Barber-Colman guarantees this and assumes complete responsibility to see that it is accomplished.

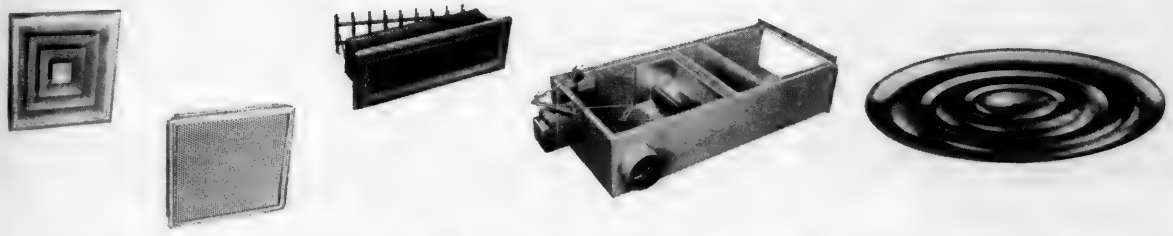
Only Barber-Colman offers you years of combined experience in both automatic controls and air distribution — and assumes the *undivided* responsibility for delivering ideal indoor weather. Architect, engineer, owner, and occupant benefit by having this important obligation successfully discharged by a single supplier.

FOR COMPLETE INFORMATION ask for new fully illustrated Bulletin F-8326 which details the benefits of temperature control and air distribution combinations available through Barber-Colman.



UNI-FLO ENGINEERED AIR DISTRIBUTION...

A complete line of air distribution products for better air handling.

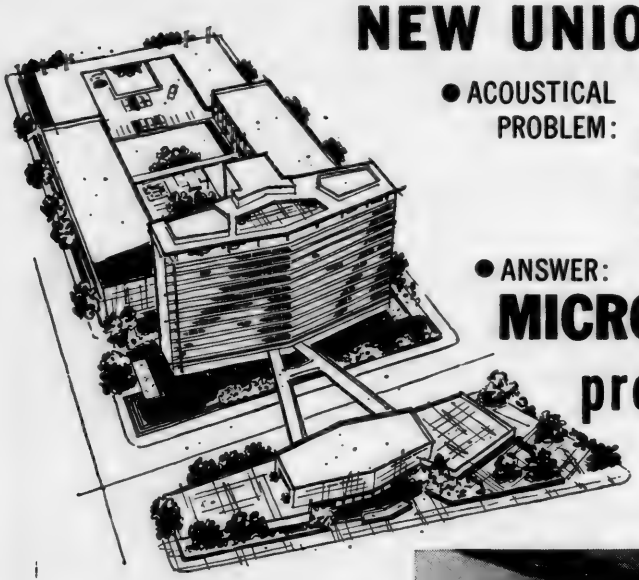


...BARBER-COLMAN COMPANY

Dept. J, 1602 Rock Street, Rockford, Illinois

NEW UNION OIL CENTER

Los Angeles, California

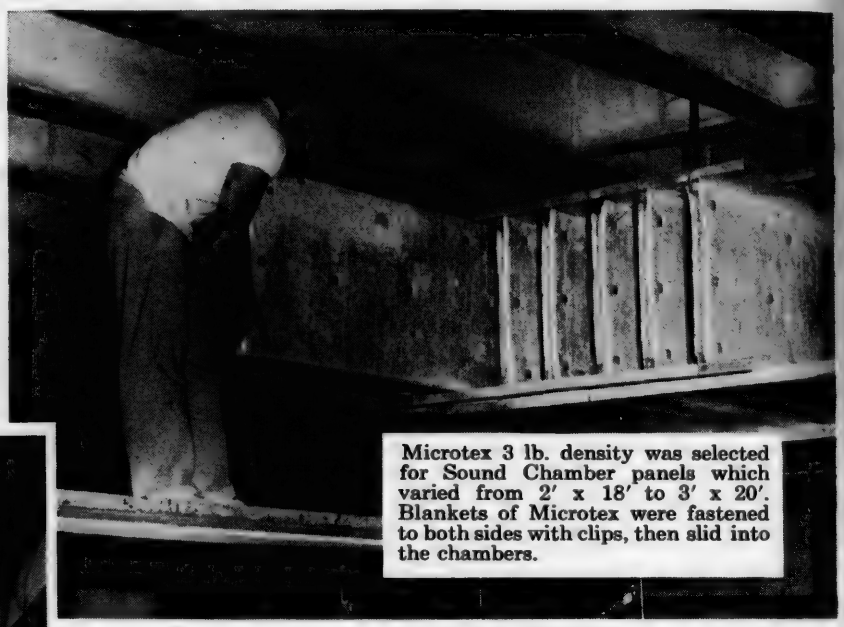


● ACOUSTICAL PROBLEM: **Supply duct velocity 3600 ft./min. Return ducts 1200 ft./min., with 8½ lbs. of static pressure: Unusually heavy equipment required to carry load; sound chambers needed to reduce high velocity noises; labor costs must be held to a minimum.**

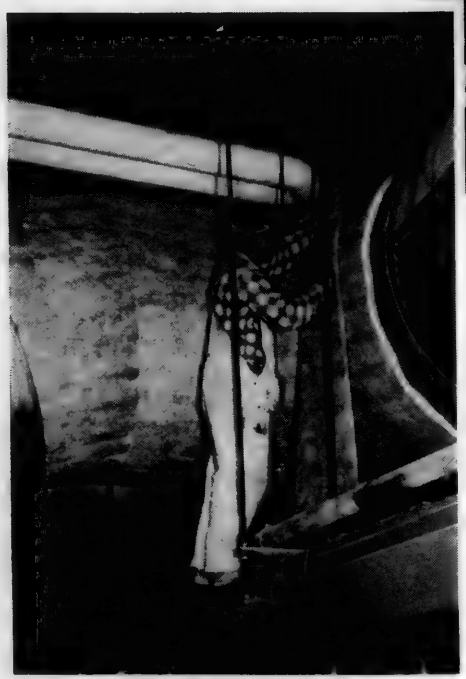
● ANSWER:

MICROTEX DUCT INSULATION provides notable insulation value per dollar

Eight carloads of Microtex Glass Fiber Insulation used in the largest air conditioning insulation job in the history of the West Coast. *Architect:* Pereira & Luckman; *Contractor:* Del E. Webb Construction Co.



Microtex 3 lb. density was selected for Sound Chamber panels which varied from 2′ x 18′ to 3′ x 20′. Blankets of Microtex were fastened to both sides with clips, then slid into the chambers.



Efficiency in Operation . . . Simplicity in Application

Nearly 80% of all insulation in the Union Oil Center is Microtex

Reason: Microtex absorbs fan and motor noises, soaks up sounds transmitted through the ducts, increases system efficiency. A low density, resilient blanket insulation, Microtex is made from fine glass fibers, bonded together, creating countless microscopic dead air cells which account for its high thermal and sound absorption characteristics.

For full information call or write any L·O·F Glass Fibers' sales office or distributor.

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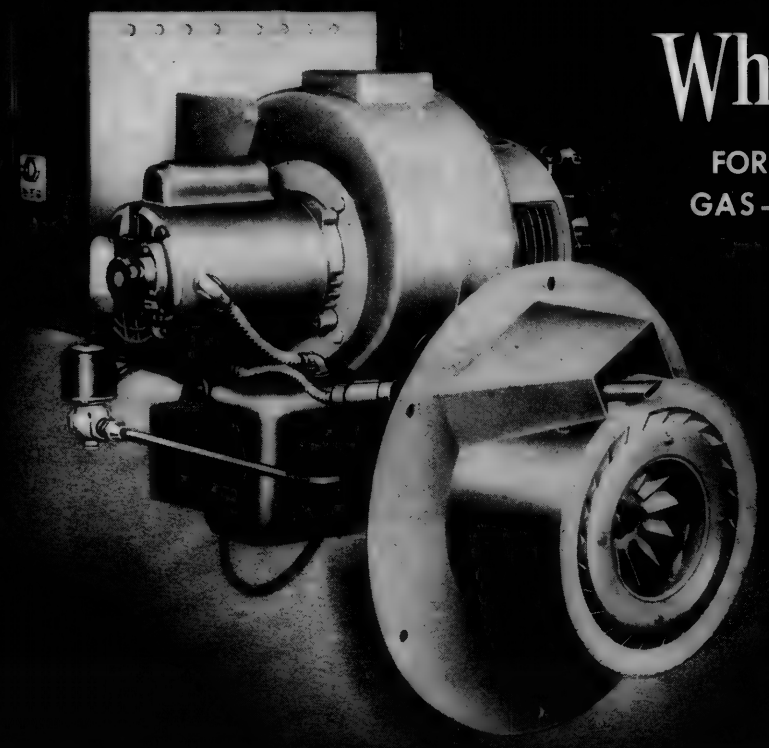
Another new development by Iron Fireman



WhirlBlast

FORCED DRAFT
GAS-OIL BURNER

Now...forced draft firing for smaller boilers

The Iron Fireman WhirlBlast gas-oil burner was created to fill the need for forced draft firing in all types of medium size boilers and particularly for the increasingly popular sealed firebox Scotch boiler. Now you can have the advantages of forced draft firing in boilers as small as 18 bhp. The necessity for costly and unsightly smokestacks has been eliminated. All air for combustion is supplied by the burner blower. No extra motors, fans or draft ports are required.

No pulsation

A newly developed firing head has solved the old problem of flame pulsation. This has been accomplished without recourse to firebox vents or other alterations.

Outstanding features of the WhirlBlast burner

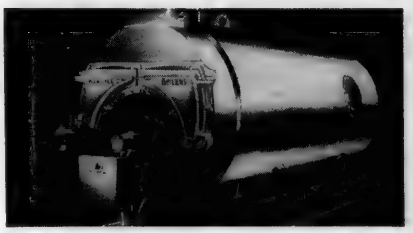
1. **Switches fuels instantly.** Fuels can be changed automatically with appropriate controls, or manually by the flick of a switch.

2. **No high smokestack.** A stub stack or vent is all that is required.

3. **For all types of boilers.** Fires sealed firebox boilers under pressure. Also greatly improves draft conditions in natural draft boilers.

4. **Easily installed.** Available with either a flange or pedestal mount. Bolts directly to the boiler front. Inverted model (with draft tube on top) permits mounting on Scotch boilers without interfering with flue doors.

5. **Fuels.** Fires No. 2 fuel oil and all types of fuel gas. Available in either oil, gas or dual fuel models.



Complete package ready to operate — boiler, burner, controls

Complete boiler-burner units assembled, wired and tested at the factory. Totally enclosed control panel is built into the burner. Wide range of sizes; easily specified by model number.

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT FOR HEATING, PROCESSING, POWER

For more information, mail coupon

IRON FIREMAN MANUFACTURING COMPANY
3074 West 106th Street, Cleveland 11, Ohio.
(In Canada, 80 Ward Street, Toronto, Ontario)

Please send more information and specifications on the Iron Fireman WhirlBlast burner.

Name_____
Firm_____
Address_____
City_____ Zone____ State____

A MODERN CONCEPT FOR

Heating, Ventilating and Cooling of Schools

By F. J. KURTH, Vice President
in Charge of Engineering, Anemostat Corporation of America

Educational efficiency

The Anemostat Dual Duct High Velocity System provides a controlled and healthy environment in accordance with the highest standards of comfort and is therefore conducive to more vigorous activity in the classrooms. It is a modern heating and ventilating system, carefully researched and new in concept, and is economical to install and operate. It is an effective heating and ventilating system, which later can be readily adapted to air conditioning by the addition of a central-station type refrigeration system.

Because large sums of money must be spent for new schools, it is important to study all factors which will improve educational efficiency. Though well constructed and equipped, many new schools are not provided with modern heating, ventilating or cooling systems which furnish comfort during all seasons of the year. Experience has shown that a proper climatic condition will improve student and teacher efficiency to the extent of a cumulative gain of approximately twenty percent.

System design

First the volume of air required for a classroom must be determined. In most communities this is regulated by local codes on a cubic foot per pupil basis.

Although requirements vary in different localities from ten to thirty cubic feet of fresh air per minute, there are other factors which must be considered: for ventilation purposes, when cooling is not used, a large volume of air will, of course, do a better job than a small volume; however, the introduction of from 1000 to 1200 cubic feet of air per minute is adequate. If air conditioning is installed, the engineer may specify air temperature differentials of 30° or more between the supply air in the cold duct and the room temperature—Anemostat Air Diffusers will diffuse air at high temperature differentials without draft.

Location and type of units

The location of the units in the classroom is determined by the climate of the community in which the school is located and the construction of the school with particular reference to glass areas. When winters are severe the *under the window type units* must be used and two units per classroom should be installed as shown on the layout. The return air can be moved through corridors, ducts in corridors or exhaust plenums in the corridor ceilings.

In schools in mild climates or in colder climates where double glazing is used, the *sidewall units* will do an excellent job of year-round heating, ventilating and cooling. Two units providing from 500 to 600 CFM each per classroom are recommended. The return air can be returned to the fan through corridors, corridor ducts or plenums.

When two units are installed in a classroom, both are controlled by one

The Basic Principle of Anemostat School Units

Typical Anemostat
Dual Duct High Velocity Unit

The illustration shows a high velocity unit designed for a dual duct system for either heating and ventilating or complete air conditioning. To maintain ideal conditions, air is evenly and draftlessly diffused at high velocity throughout the classroom at controlled temperature; one duct carries cold air from the outside of the building, or cold air cooled by coils and mechanical refrigeration, the second duct carries warm air, which consists of a mixture of fresh and recirculated air heated by hot water or steam coils from heating boilers or by hot air furnaces. The thermostat in the classroom opens the hot air valve and closes the cold air valve, or vice versa depending on the room temperature requirements.

thermostat which should be located on an inside wall.

Ducts

The ducts can be installed in various ways depending on the type of structure: beneath the floor, on classroom or corridor ceilings, in roof spaces or on top of the roof. If tile or transite pipe is used the ducts can actually be buried in the ground. Because no water or steam is used, the ducts can be run in practically any space, as corrosion or trapping is not a problem.

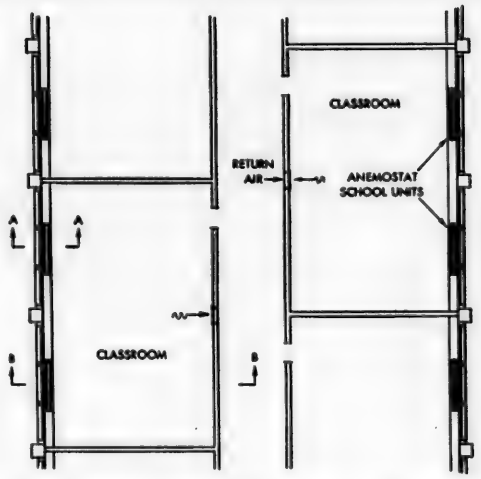
Equipment room

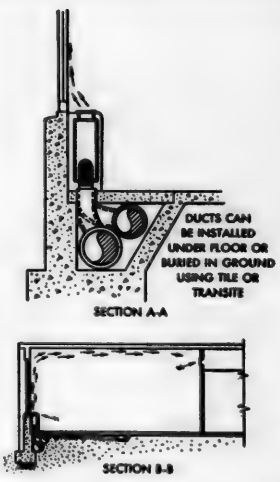
For reasons of economy, the fan room or rooms should be so located as to keep the duct runs as short as possible. However, there is no problem in running ducts long distances; dual duct systems in commercial buildings often have duct-runs of over 500 feet. The fans are usually of the Class II type and can be either the forward or backward curve type. Consideration should be given to fans of the air-foil type, which are designed for quiet operation at high pressures.

Mechanical or electrostatic filters are generally used in high class commercial buildings and should also be considered for schools. Clean, filtered air properly diffused at controlled temperature is the answer to health and comfort in classrooms.

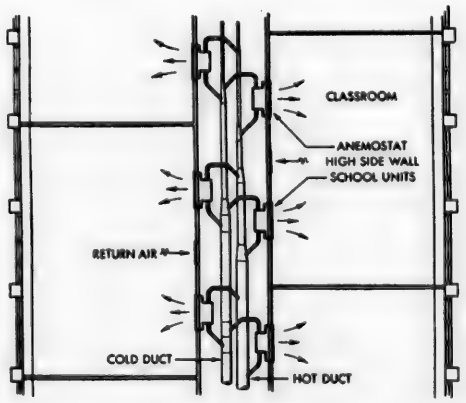
TYPICAL CLASSROOM LAYOUTS

High Velocity Under the Window Units

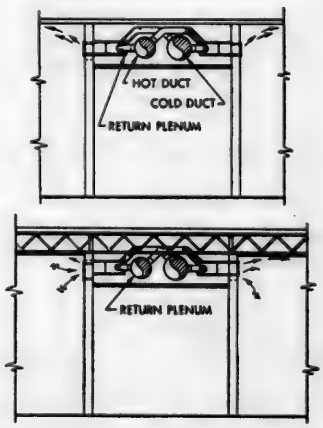




High Velocity High Sidewall Units Installed in Corridor Ceiling



Typical Sections Showing High Sidewall Type of Installation



AC-1362

Advantages of the Anemostat Dual Duct High Velocity System

The Anemostat dual duct high velocity air distribution system for heating, ventilating and cooling is ideal for all types of classrooms from kindergarten through college. It offers many important architectural and engineering advantages:

1. *Low First Cost*
2. *Low Maintenance Costs*
3. *Draftless Air Distribution*
4. *Eliminates Window Down Drafts*
5. *Scientific Temperature Control*
6. *Easily Adapted to Future Air Conditioning*
7. *Quiet Operation*
8. *Rugged Construction*
9. *Meets All Code Requirements*
10. *Pressure Balanced*
11. *Meets Modern Architectural Design*

New Anemostat School Catalog

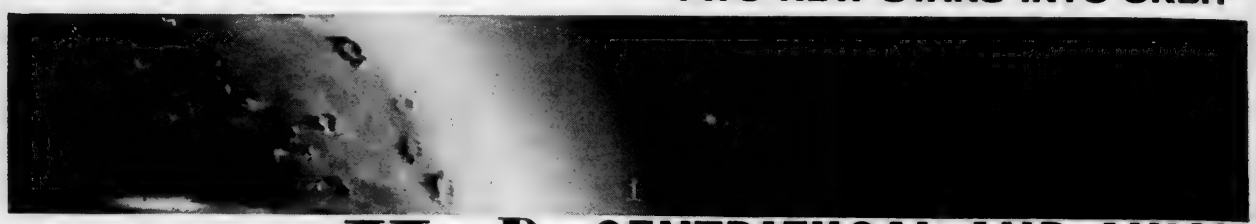
contains complete data on Anemostat Dual Duct High Velocity Units. Write for your copy to

Anemostat Corporation of America

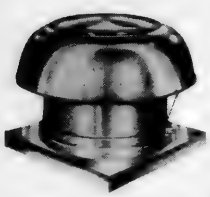
10 E. 39 Street, New York 16, N.Y.

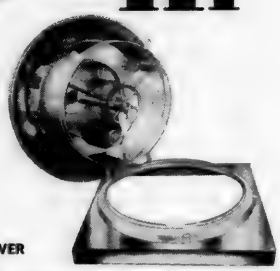
JENN-AIR LAUNCHES

TWO NEW STARS INTO ORBIT

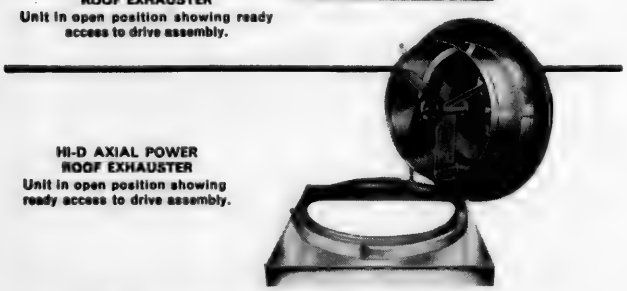


Hi-D CENTRIFUGAL AND AXIAL POWER ROOF EXHAUSTERS





HI-D CENTRIFUGAL POWER ROOF EXHAUSTER
Unit in open position showing ready access to drive assembly.



HI-D AXIAL POWER ROOF EXHAUSTER
Unit in open position showing ready access to drive assembly.

Observe These Outstanding Features Shared in Common by 2 New Jenn-Air Hi-Discharge Exhausters:

1—*Maintenance-Free all-aluminum housing* supplies strength without weight.

2—*Bird guard* of heavy gauge stainless steel construction comes as an integral part of every unit.

3—*Special vibration absorbers* reduce noise to an absolute minimum.

4—*Totally enclosed* full ball bearing, permanently lubricated, motor assures smooth, uninterrupted service. Air cooled application adds years to motor life.

5—*Tubular drive assembly* has permanently sealed, pre-lubricated ball bearings.

6—*Motor and drive* can be serviced from interior of building, if desired.

7—*Specially designed hinge* on housing permits ready access to damper and drive. Positive stopping device holds unit in open position. Simple locking mechanism keeps it tightly closed.

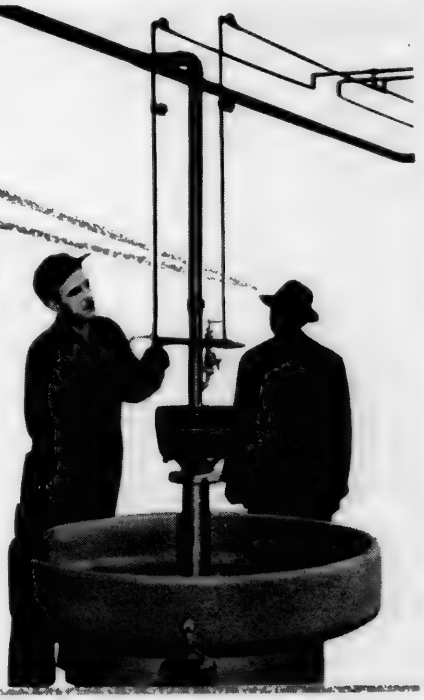
Now, for the first time, aluminum belt driven units combine high discharge with low-contour appearance

Since 1947 the power exhauster industry has looked to Jenn-Air for leadership. Now Jenn-Air starts its second decade by introducing two new and useful additions to its line: Hi-Discharge *Centrifugal* Power Roof Exhauster, Series HCB; and Hi-Discharge *Axial* Power Roof Exhauster, Series HAB. These exhausters fill the need for general area ventilation and have a clean engineering design that features compactness and serviceability. By locating the wheel at the top you derive the advantage of a high point of discharge which allows low curb construction. Thus, Jenn-Air units offer the lowest overall height of any exhauster on the market. Once you compare, you will decide on Jenn-Air.

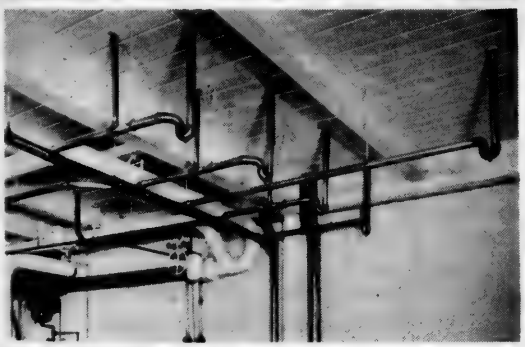
JENN-AIR PRODUCTS COMPANY, INC.
1102 Stadium Drive • Indianapolis 7, Indiana

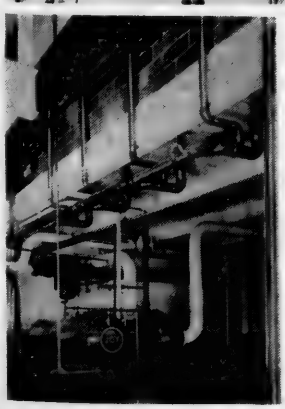
Member of Air Moving and Conditioning Association

"On job after job we've found COPPER DWV lines cost less to install, need less room and are easier handled,"



Says Robert K. Warfel, President
WARFEL PLUMBING & HEATING COMPANY
Elkhart, Indiana





(Top)
IN THIS LARGE VENT installation of wall-hung gang closets, note what a neat joining job can be done with Copper DWV lines and precision, solder-type fittings.

(Center)
11,548 lbs. of Revere Copper Water Tube and Copper DWV lines were used in this plant, in sizes ranging from ½" Type L to 6" DWV. Uses covered roof and sanitary drainage, water and air piping.

(Bottom)
THERE'S NO TROUBLE running Revere Copper vent lines, even when they're as close as this. Soldering or brazing of copper tube can be done with ease and speed in the tightest corners.

"When you consider all the advantages of Copper DWV lines you don't have to be a mathematician to figure the savings that are realized. There's no laborious, time-consuming thread cutting, they are easier to handle, need fewer hangers, take up less space and we can prefabricate many of the assemblies right in the shop. No wonder Copper DWV lines cost less than rustable materials to install. And, with soldering or brazing, fast, tight joints are always possible.

"With the wall hung type of closet becoming increasingly popular for home use we found Copper DWV joined with easy-to-solder wrought fittings an ideal combination. The top photograph at left shows a typical hook-up in multiple unit installation."

Contractors and owners, too, have found that Copper DWV lines will not rust, that their gun-barrel smooth interiors make clogging virtually impossible, and that, once the installation is made call-backs are a thing of the past.

Make your next job 100% copper. Keep tabs on costs and prove for yourself that it costs less to install copper, whether it be DWV lines, heating, air conditioning, processing or hot and cold water lines. See your Revere Distributor who is prepared to fill all your needs.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

Mills: Rome, N.Y.; Baltimore, Md.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities, Distributors Everywhere.

Complete-line air-conditioning lets Worthington dealers

CUSTOM-QUOTE EVERY JOB!

Probably the most complete line of air conditioning equipment in the world—*Worthington, naturally*—is signing on a select group of new air conditioning dealers—*yourself, possibly?*

Many, many different models permit these *fortunate* dealers to put together the most efficient and economical combinations of air conditioning equipment for any *specific* job. Handling *exactly* the right equipment for every air conditioning problem eliminates equipment compromises, means these *smart* dealers can "custom-quote" on every job. And behind this job-tailored equipment stands 70 years of respected Worthington experience and front-line service. (Incidentally, these same *intelligent* new dealers will find that Worthington equipment is backed by a 5-year warranty which includes a generous dealer labor allowance.)

Interested in quoting on equipment fashioned to the job, not jobs fashioned to the equipment? Interested in increasing your sales, cutting down on lost orders? If so, *Worthington wants you—and you'll want Worthington.* Write today for the complete air conditioning story. Worthington Corporation, Air Conditioning and Refrigeration Division, Section 12-4, Harrison, N. J.

WORTHINGTON

WORTHINGTON'S COMPLETE COMMERCIAL AND INDUSTRIAL AIR CONDITIONING LINE INCLUDES:

Flexi-cool line: Air-cooled, ceiling-mounted, split systems • Water-cooled, self-contained, ceiling-mounted units • Smallest floor-mounted unit available • Hang it, lay it down, stand it up • Vertical and Horizontal cooling coils • Remote water-cooled packaged unit • Water-cooled self-contained packaged unit • Air-cooled packaged units • Air-cooled condensers • Air-cooled condensing units • Packaged water-chillers — hermetic and open • Reciprocating compressors • Air handling units • Evaporative coolers • Evaporative condensers • Fan and coil units

PETRO *SuperCharger* OIL BURNER

HAS THESE THREE ADVANTAGES

1 Fires low cost heavy oils in medium size heating plants.

2 Forced draft firing eliminates high stacks.

3 Control panel, firing and draft mechanism in single, compact unit, factory wired and tested. Entire combustion system installed by bolting to boiler front.

LOW COST HEAVY OILS FIRED WITH COMPLETE DEPENDABILITY
Heavy oils, including No. 5, can now be fired with complete dependability in a gun type burner and with as little maintenance and supervision as a residential oil burner. The SuperCharger atomizing principle reduces even No. 5 oil to a vapor-like mist, using the self-generated heat resulting from compression of the air-oil mixture, to produce the highest degree of heavy oil atomization ever achieved.

NO GAS PILOT NEEDED—STARTS WITH ELECTRIC IGNITION
Ignition is positive, instantaneous and dependable. No complicated pre-purge gas safety controls required. Eliminates the need for expensive and involved gas piping.

LOW FIRE STARTS—FULL MODULATION
The Petro SuperCharger burners are available in models with:
1. Fixed firing rate that can be manually adjusted at any level desired.
2. Two-position firing with low-fire start.
3. Fully automatic modulation, with firing rate constantly adjusted to the load.

COMPLETE BOILER-BURNER UNIT—OR BURNER ONLY
Can be ordered as a complete boiler-burner unit, with Scotch boiler and forced draft fan, ready for service connections. Also available as a conversion burner which can be applied to any boiler, for either natural, forced or induced draft.

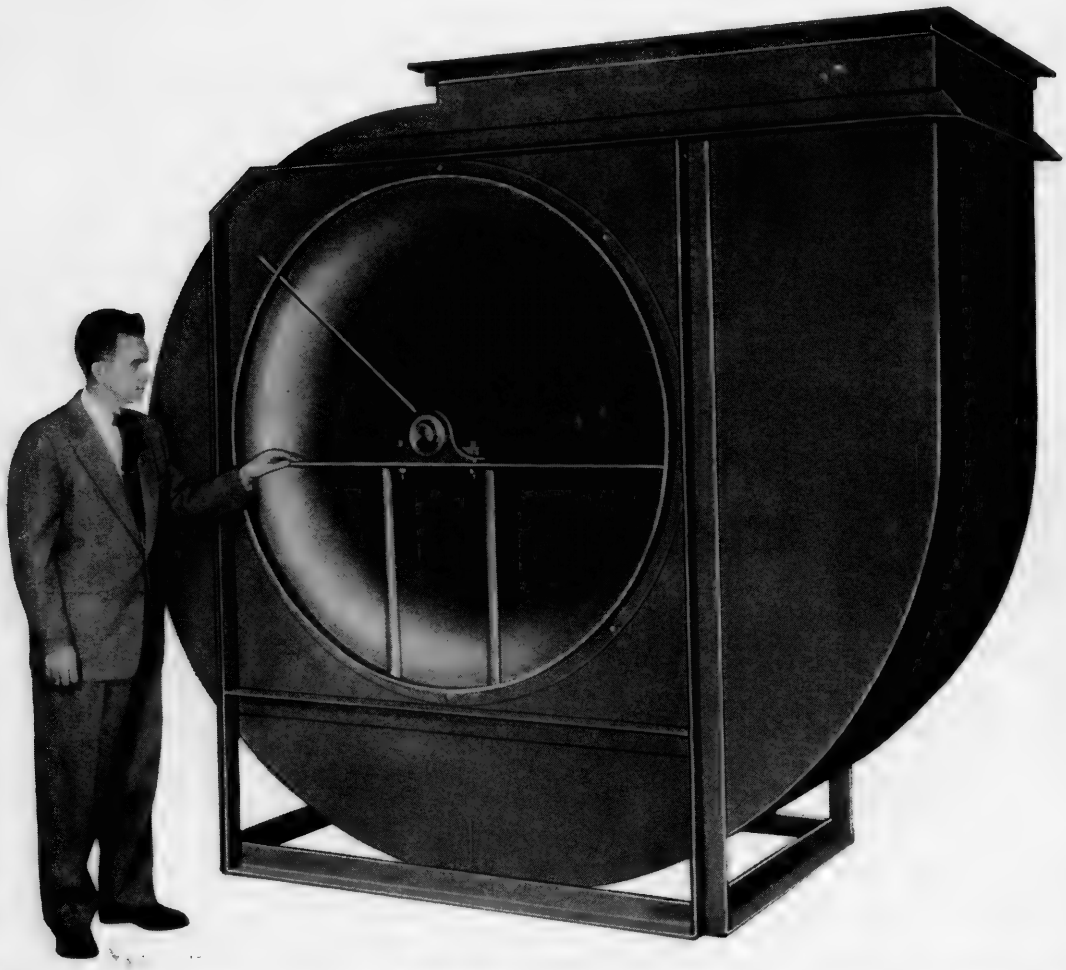
For more information and specifications, please mail the coupon, or see Petro Catalog in Sweet's Architectural File.

PETRO
T. M. REG. U. S. PAT. OFF

Makers of quality heating and power equipment since 1903

PETRO
3229 West 106th Street, Cleveland 11, Ohio
(In Canada: 80 Ward Street, Toronto, Ontario)
Please send me more information on the new Petro SuperCharger Burner.

Name.....
Company.....
Address.....
City.....Zone.....State.....



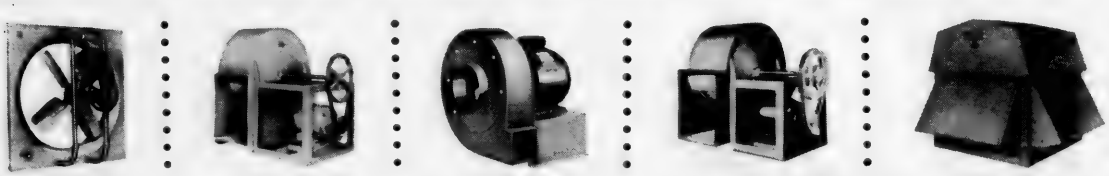
BIG BLOWERS ARE BIG BUSINESS WITH PEERLESS

QUIET! • TROUBLE-FREE! • DEPENDABLE! • HEAVY DUTY! • GUARANTEED!

Versatility in size, application, and engineering has always been a Peerless strong point. Peerless builds its own motors and matches them to the specified blower requirements. Peerless blower frames and housings are usually heavier than any competitive products. Result—a quiet, vibration-free unit.

These are not "off-the-shelf" units, but built to customer rotation and discharge specifications. Each one receives 100% inspection before it leaves the Peerless factory. Each unit is built to NAFM standards. Motors are built to NEMA standards. Each unit is ready for operation when received at the installation site.

A COMPLETE LINE OF AIR MOVING EQUIPMENT



Charter Member of the Air Moving and Conditioning Association, Inc. (AMCA)

Peerless Electric

FAN AND BLOWER DIVISION

THE *Peerless-Electric*® COMPANY

1400 W. MARKET ST. • WARREN, OHIO

FANS • BLOWERS • ELECTRIC MOTORS • ELECTRONIC EQUIPMENT

Write Today for Bulletins SDA-220, SDA-200 and SDA-160.

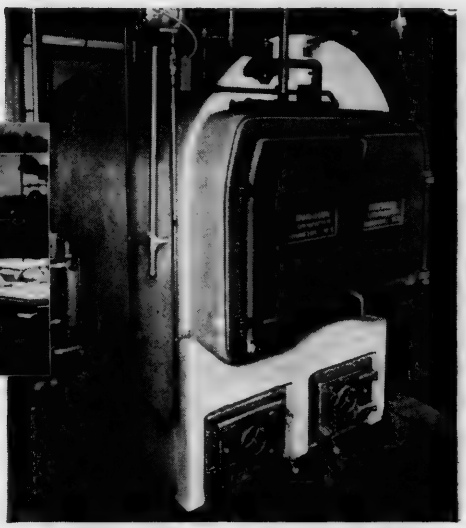
NEW BURNHAM SCOTCH TYPE BOILER FOR OIL, GAS, OR OIL/GAS COMBINATION

The hit of the O.H.I. Show, over 10,000 members of the heating trade stopped to see this versatile new packaged steel boiler. Its burners were selected after exhaustive testing to find the ideal combustion units to package with the fine Burnham boiler. It is factory assembled and tested . . . ready for final piping and wiring connections. Available in 8 sizes, Certified Ratings from 4,740 to 12,750 sq. ft. E.D.R. steam. Comparable ratings for water. Standard Scotch Type models available in sizes up to 4,000 sq. ft. of heating surface.

BURNHAM'S "OLD RELIABLE" COMPACT TYPE BOILER

...ideal for schools, apartments, all commercial buildings

MUTUAL OLDSMOBILE, INC. ..... *(Springfield, Mass.)*
J. C. PLANTE & SON, INC. ..... *(East Long Meadow, Mass.)—Heating Contractor*
UNITED PLUMBING SUPPLY, INC. .... *(Springfield, Mass.)—Wholesaler*



Mutual Oldsmobile's Burnham 60-98 Compact Type Boiler is oil-fired for hot water heating. Has induced draft fan and tankless domestic hot water heater.

For compactness, reliability and fuel efficiency, these welded steel boilers have been famous for over 25 years. They compress the utmost heating capacity into the practical minimum of floor space. Compact Type Boilers are available in capacities from 2,600 to 35,000 sq. ft. E.D.R. net steam, with comparable ratings for water. All are S.B.I. ratings.

Burnham Corporation

STEEL BOILER DEPARTMENT
IRVINGTON, NEW YORK

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Sales Representatives throughout the U.S.A.

Burnham Corporation ACH-108
Steel Boiler Dept.
Irvington, New York

Please give me, without obligation, full ratings and data on:
Scotch Type Boilers ☐ Boiler-Burner Packages ☐ Compact Boilers ☐

Name .....
Address .....
City ..... State .....

GAS-fired* CARRIER

ABSORPTION REFRIGERATION PROVIDES TROUBLE-FREE, ECONOMICAL COOLING AT THE U.S. AIR FORCE ACADEMY

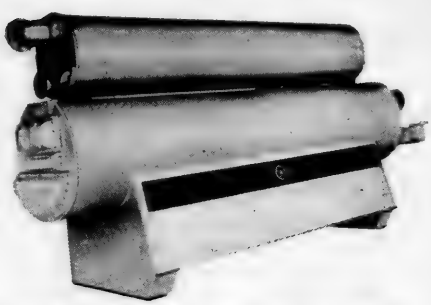
The new United States Air Force Academy perched at 7,200 feet above sea level near Colorado Springs and Pikes Peak, soon to house 1,145 Cadets.

To provide cooling comfort, the new Academy is equipped with the nation's most efficient, up-to-date type of air-conditioning—gas-fired Carrier Absorption Refrigeration.

The absorption refrigeration unit makes use of one of the oldest and most reliable principles of refrigeration. No prime mover is required, only low-pressure steam or hot water. Seasonally idle or excess boiler capacity can be put to use on a year 'round basis. *This same type of automatic operation can put your heating system on a year 'round paying basis, too!*

With gas as the boiler fuel,* operating costs are cut to a minimum. This gas-fired Carrier machine operates without noise and vibration . . . and because it is so compact and lightweight, it can be put almost anywhere—from basement to roof.

This is only part of the story of the efficiency and economy of specifying gas-fired Carrier Automatic Absorption Refrigeration equipment. Specific performance, engineering data and cost details are yours for the asking. Just call your local gas company, or write to the Carrier Corporation, Syracuse, New York. *American Gas Association.*



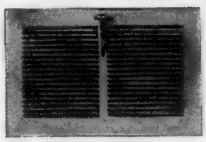
Gas-fired Carrier Automatic Absorption Refrigeration

- cuts operating expense
- lowers installation cost
- provides quiet, vibrationless operation
- answers space and weight problems
- automatically adjusts to varying loads

sure signs of indoor comfort!

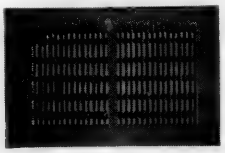
Standard Registers & Grilles

. . . for custom control of warm air heating



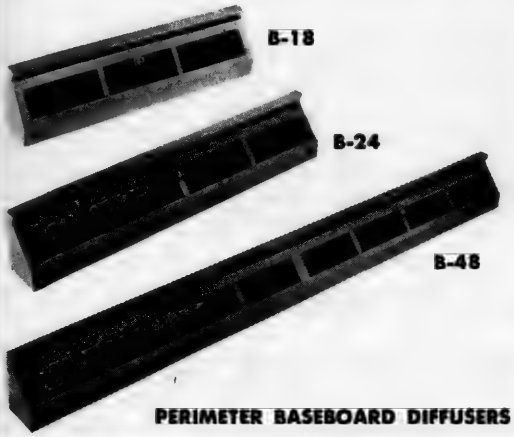
#41 H WALL

SINGLE DAMPER FORCED AIR REGISTERS



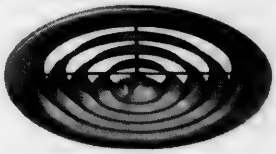
#331 WALL

MULTIPLE VALVE SIDEWALL & BASEBOARD REGISTERS

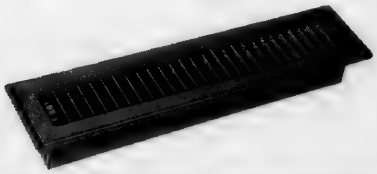


PERIMETER BASEBOARD DIFFUSERS

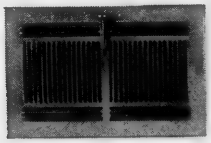
. . . for uniform, year-around heating and cooling comfort



CEILING AIR DIFFUSERS (flush and extended)

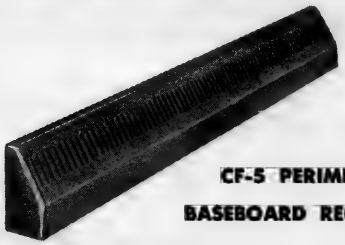


PH SERIES PERIMETER FLOOR REGISTERS



#551 WALL

PERIMETER BASEBOARD REGISTER NO. 551



CF-5 PERIMETER BASEBOARD REGISTERS

Also: return air grilles, baseboard and sidewall intakes, air cond. and ventilating returns, door grilles, floor registers, cold air faces, frames, ornamental metals.

Install Standard Registers and Grilles on every job to save time and increase customer satisfaction.

STANDARD STAMPING

. . . first in engineering for indoor comfort!

Standard Stamping & Perforating Co.
3141 W. 49th Place, Chicago 32, Illinois

Gentlemen: Please send me your new catalog showing the complete line of Standard Stamping Registers and Grilles.

Name_____

Company_____

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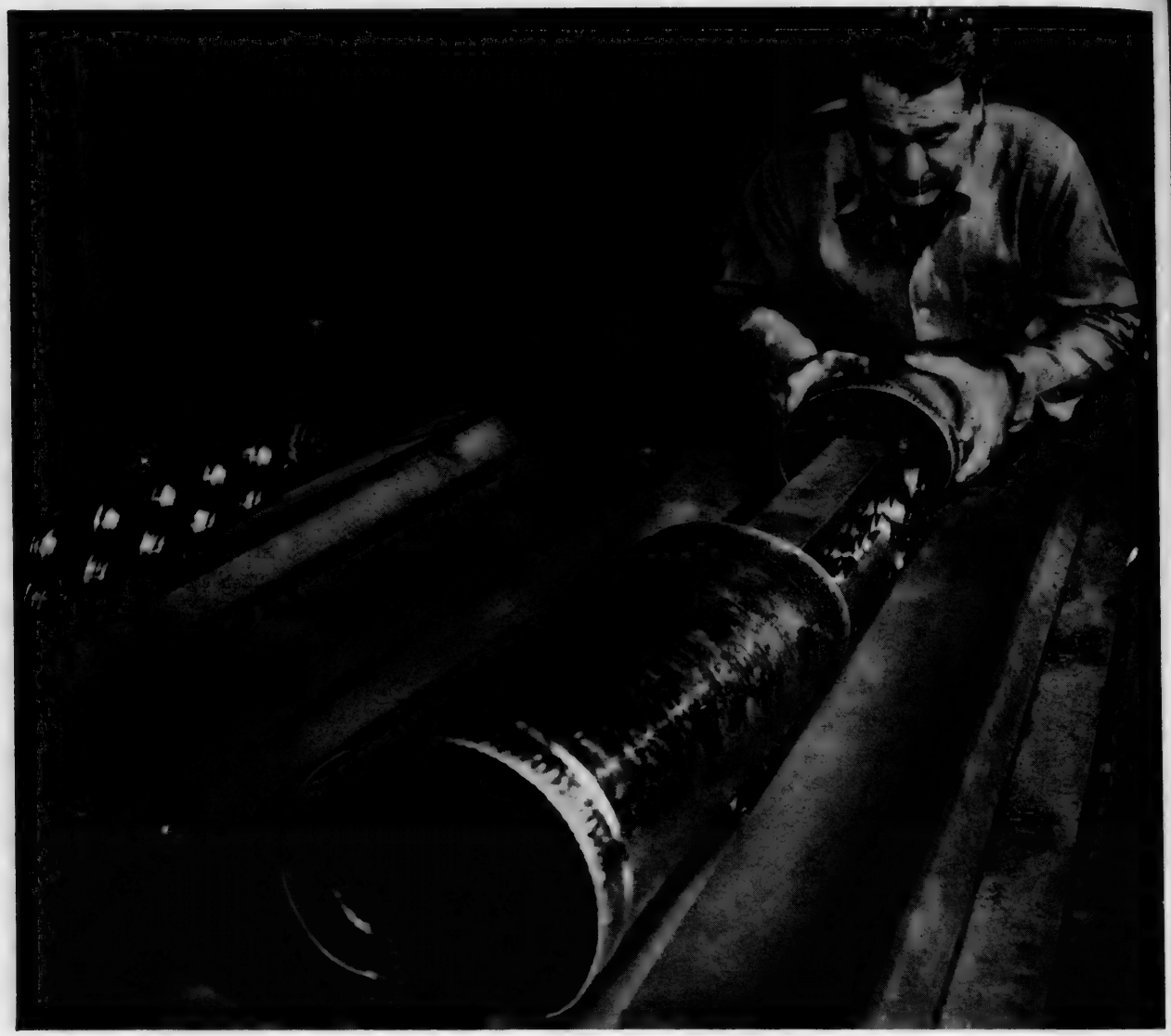


Bethcon coating stays tight in the toughest forming jobs

You can make snap locks, Pittsburgh lock seams or some special seam of your own without damaging the zinc coating on a Bethcon sheet. That's because Bethcon is galvanized by a continuous process which bonds the zinc to the base metal much more tightly than conventional methods.

This same process also distributes the zinc evenly over the sheet, producing a finished sheet of uniform thickness and appearance. It also eliminates the bead usually found on the drip ends of hot-dipped sheets.

Another advantage of the Bethcon continuous galvanizing process is the remarkable combination of strength and ductility in the sheet. That's because the basic steel receives a special annealing in the continuous line. You'll find a Bethcon sheet neither too soft nor too stiff, but just right for easy workability and a sturdy end-product.

You can specify Bethcon in any gage from 13 on up, in plain steel or copper-bearing (Beth-Cu-Loy) for extra corrosion-resistance. If you have not yet worked with Bethcon, you might like to talk with someone who has. Or perhaps you'd prefer to discuss it with one of our own men. Either way, you'll get prompt attention by getting in touch with our nearest district sales office.

You really ought to try Bethcon. Why not call us now?

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

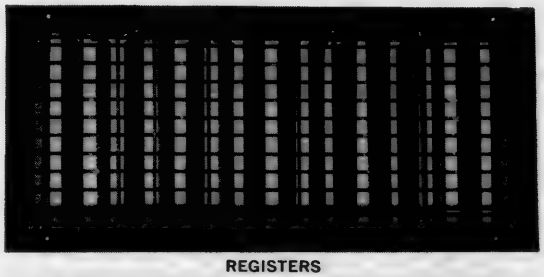
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

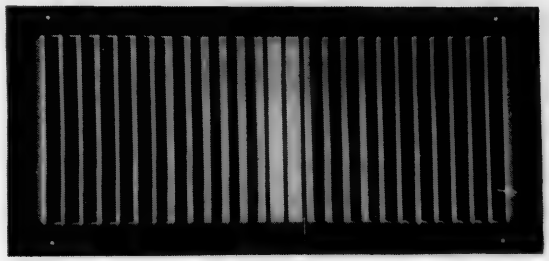
BETHLEHEM STEEL

NOW AGITAIR® REGISTERS and GRILLES

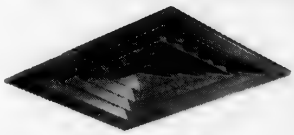
(formerly STEWART)



REGISTERS



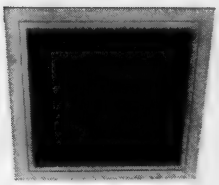
GRILLES



SQUARE & RECTANGULAR DIFFUSERS

CIRCULAR DIFFUSERS

STRIPLINE DIFFUSERS

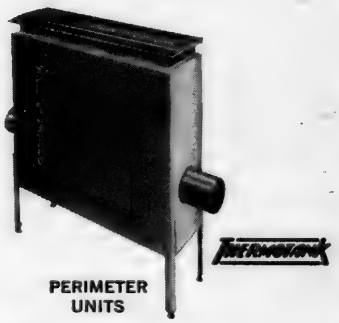


PERFAIR PERFORATED DIFFUSERS

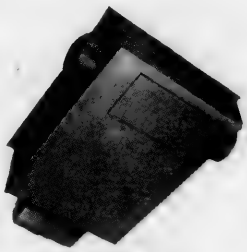
Air Devices Inc., has acquired the complete line of STEWART Registers and Grilles to add to job proven AGITAIR Diffusers, Filters and Exhausters...THERMOTANK High Velocity Mixing Boxes and Punkah Louvres.

Now from one source, Air Devices Inc., you can select with confidence and specify any AGITAIR product and be assured that the item or items selected will meet every performance and architectural requirement.

All Air Devices Inc. representatives have practical "on the job" experience in the application of Agitair products. They will gladly assist you in the selection, sizing and application of these products.



PERIMETER UNITS



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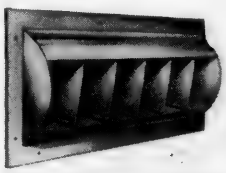
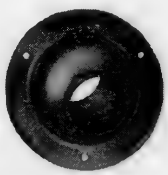


DRUM PUNKAH LOUVRES



ROUND PUNKAH LOUVRES

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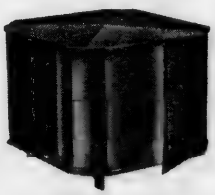

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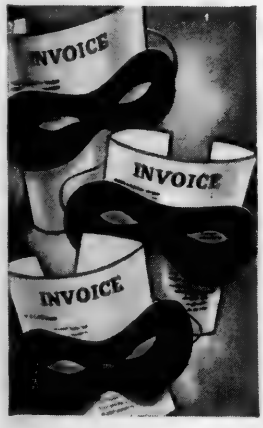

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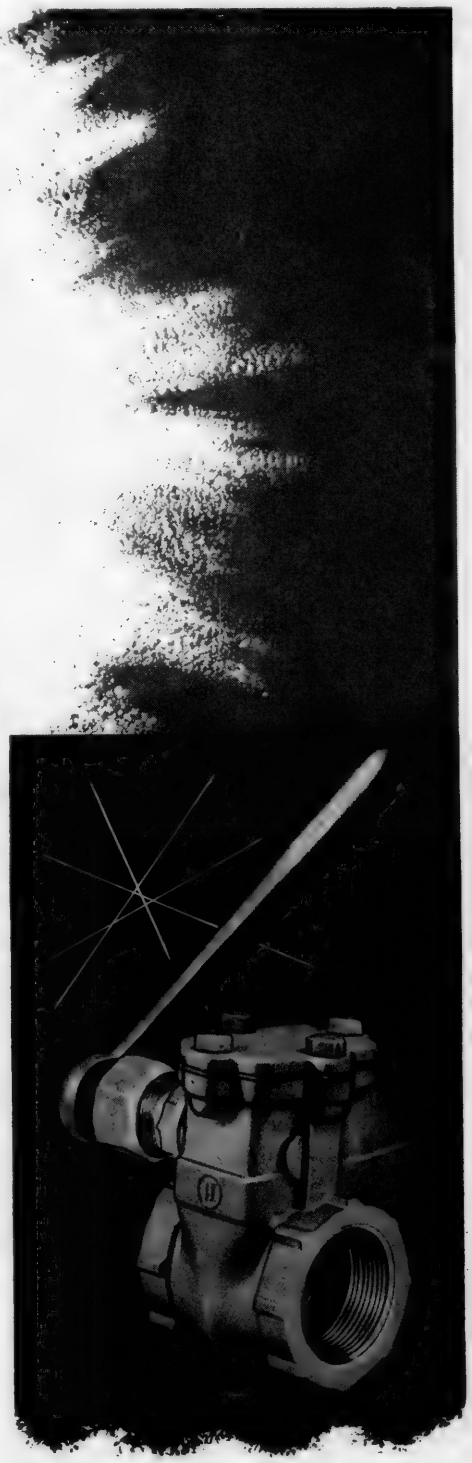

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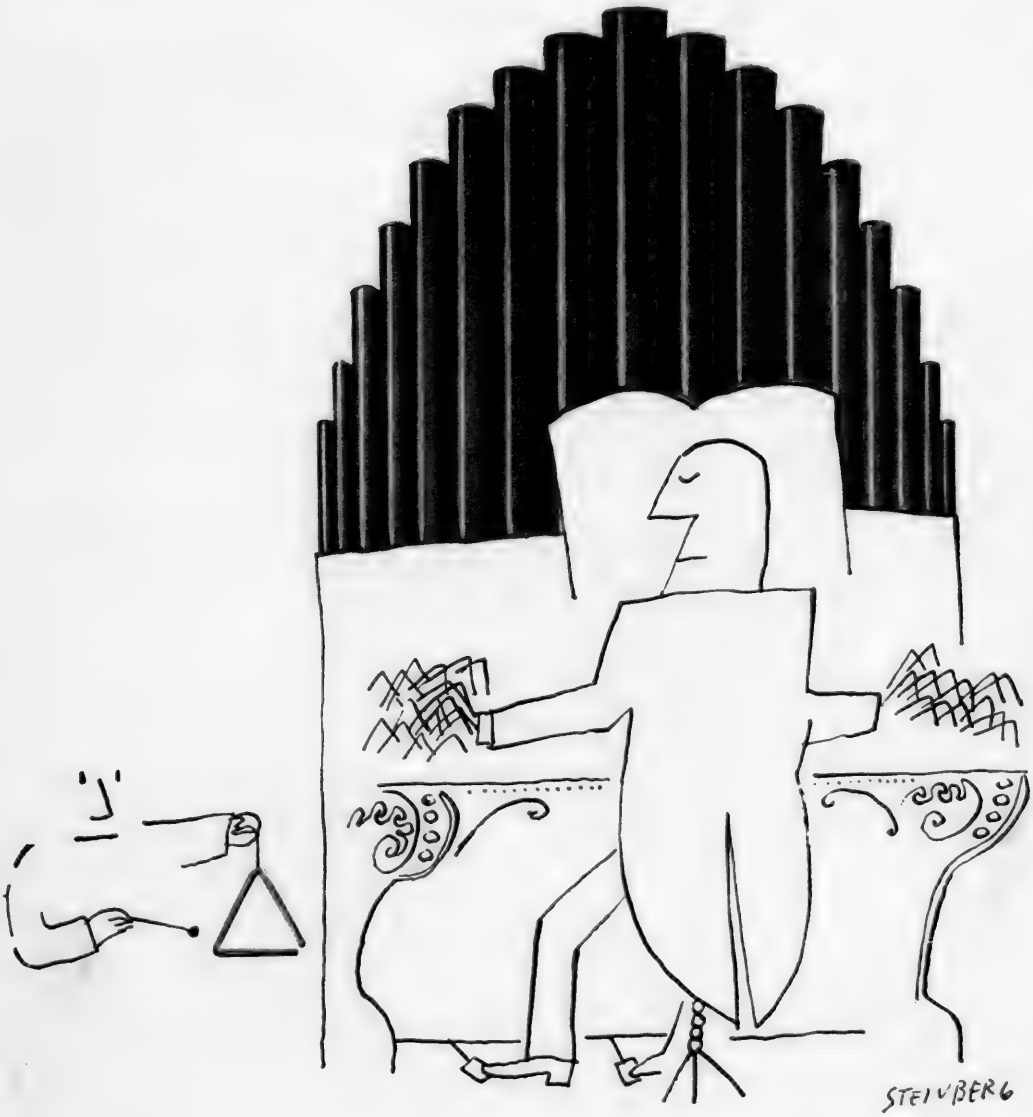

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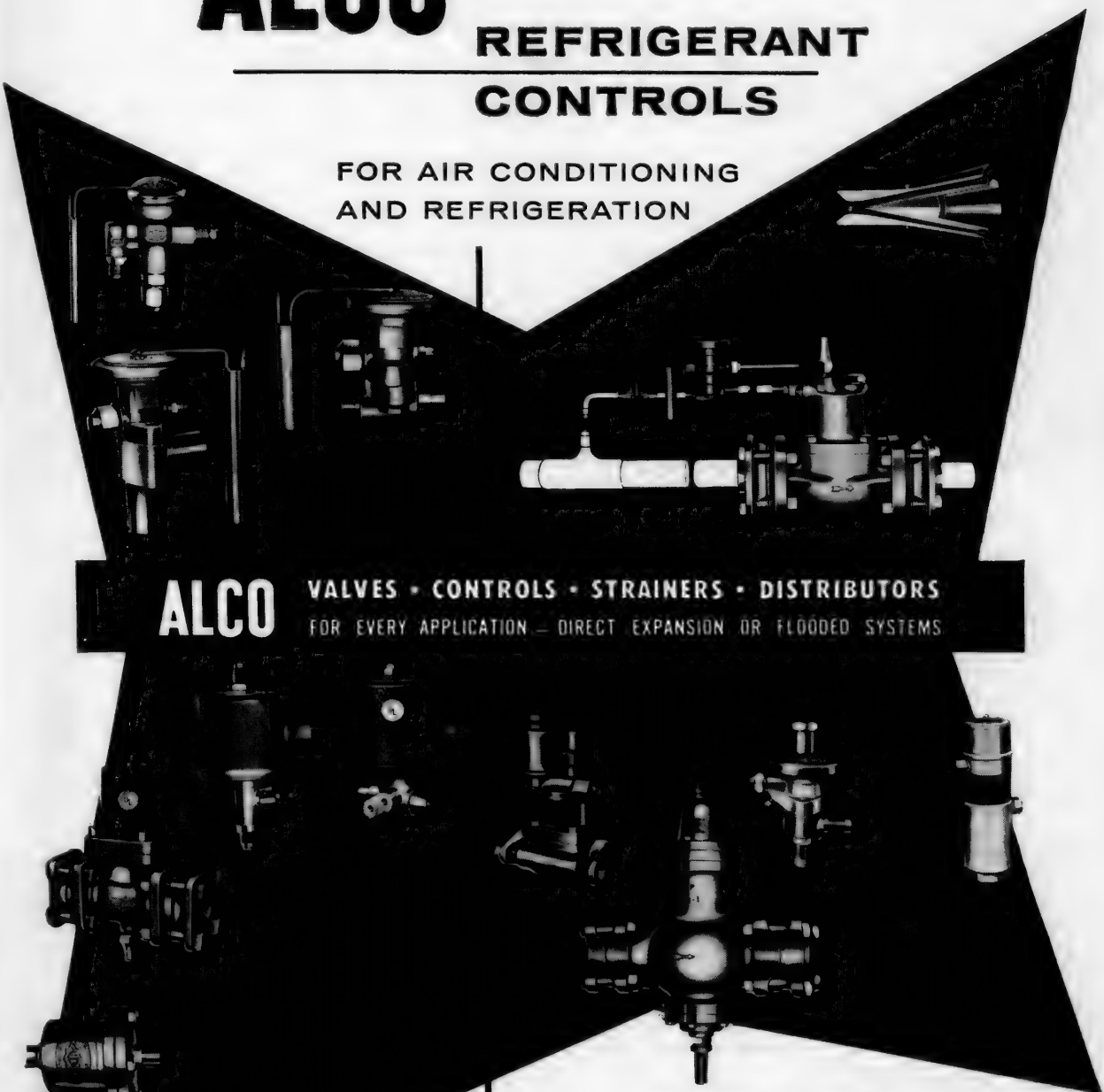

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by Owen S. Lieberg
Consulting Engineer

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   Arguments for HTW. Brief history. Sample calculation comparing HTW to steam.
2. **Thermal Properties of Water**
   Basic thermodynamics. Units defined. Property tables for water and steam.
3. **Some Design Considerations**
   Temperature drop, system pressure, thermal storage, system flexibility, secondary steam.
4. **Pressurizing the System**
   Reviews pressurizing methods: Steam, air, inert gas. Special cases; heat-power systems.
5. **Boilers and Expansion Tanks**
   Boiler selection. Water tube boilers. Summer load conditions. Sizing expansion tanks. Nitrogen pressure tanks.
6. **Controlling the System**
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   Great detail covering the "heart of the system." Guarding against flashing. Pump specs. Friction heads. Parallel pumps. Auxiliaries, drives, piping.
8. **Valves**
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13. **Designing a Typical System**
    Ten-step design procedure for any HTW system. Theory and practice summarized and applied to complete design example.
14. **Appendix**
    A complete specification of a typical boiler plant and auxiliaries for a high temperature water system.

THE AUTHOR

Owen S. Lieberg, a graduate of Polytechnic Institute, London, brought his specialty in heat distribution, both steam and hot water, to the United States as consultant in 1928. During World War II, he returned to England to head a fortifications unit of the Corps of Royal Engineers. He returned to the United States in 1946 to practice as a consulting engineer. Among important projects on which he has served as consultant are the largest HTW system in England (Bicester Ordnance Depot) and many U.S. installations including the HTW systems at the Forbes and Olmstead Air Force Bases and the Cross Company factory in Detroit. He also designed the HTW system for Canada's Camp Gagetown, N. B., largest military establishment in Canada.

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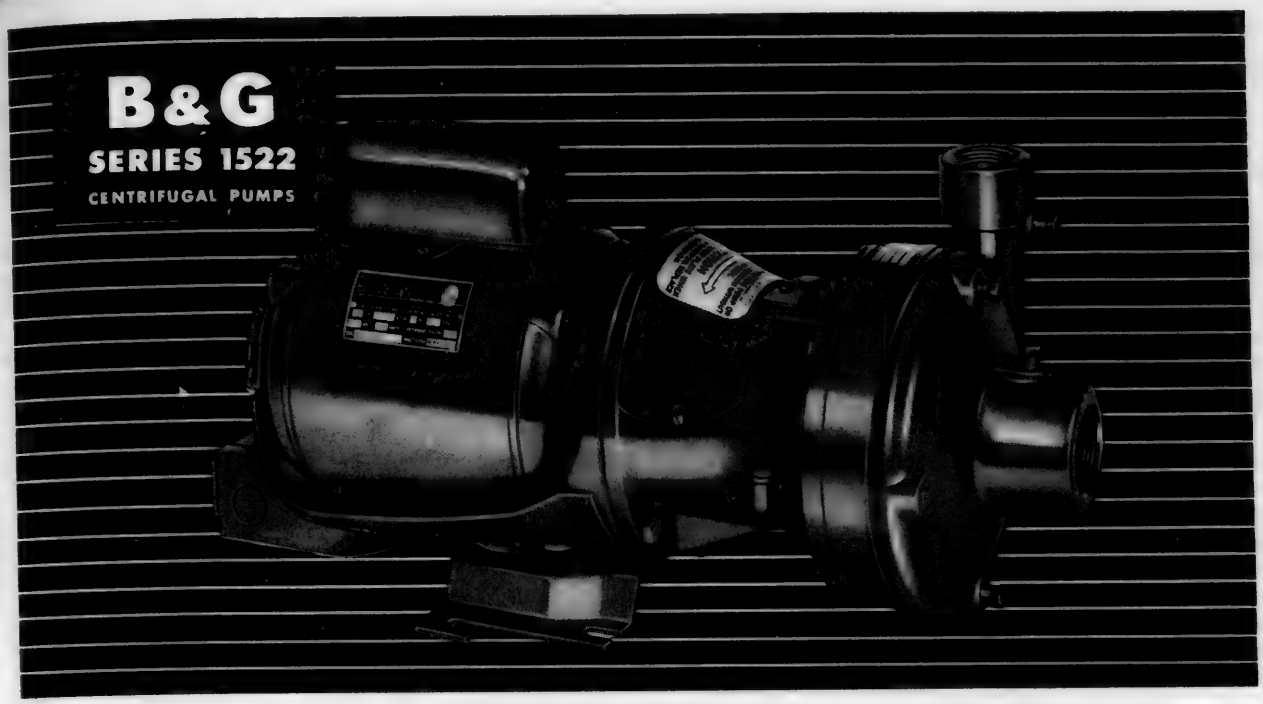

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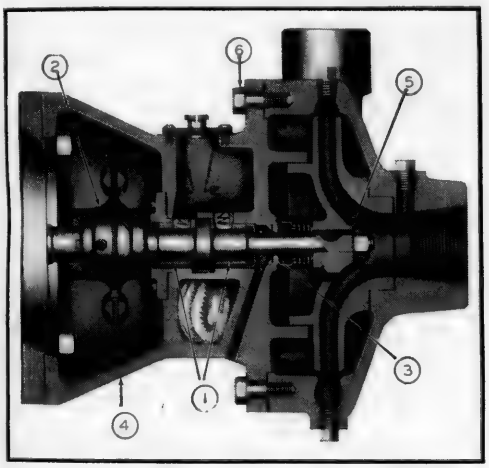

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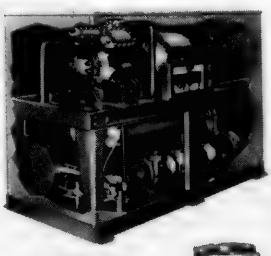

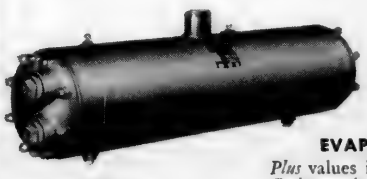

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- Increased air capacity induces rapid system response without wasteful overheating.
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- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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Air Conditioning Economics

C. L. RINGQUIST
Manager, Applications Engineering
The Trane Company

Is it possible to accurately calculate the costs of installing and maintaining an air conditioning system for big building application? The author, answering that it is if a complete economic analysis is made beforehand, then proceeds to outline such an analysis, including First Cost, Fixed Charges, Maintenance and Service Charges. A bonus feature is a comprehensive maintenance check list for some of these systems.

IS it possible to accurately calculate the costs of installing and maintaining an air conditioning system for big building application?

It is if a complete economic analysis is made beforehand.

To begin, we should be familiar with the three general categories in which investments in air conditioning systems can be classified.

Investment to Increase Profit is of interest to the buyer who expects the installation of an air conditioning system to increase his business to the point where his increased profits will liquidate his investment over a period of time. In this classification, we can place buyers of air conditioning systems for hotels, motels, theatres, etc. In some types of business, the profits are tangible and can be easily evaluated. In other businesses, the profits are less easily evaluated, even though the results are just as real.

Investment to Maintain a Profit is of interest to the buyer who must air condition to maintain his profit. In order to buy air conditioning, he must amortize the cost over a number of years. He must know how much capital will be tied up, the annual interest upon this capital, over how many years he can charge depreciation on the equipment and the owning and operating costs. In fact, the nature of his business is such that low owning and operating costs are of vital importance.

Investment for a Quick Profit concerns the speculative buyer who is interested in making an immediate profit by disposing of his holdings soon after his investment has been made. This type of investment is also of interest to the businessman who cannot consider the investment except on a short-term basis because of the nature of his business or because of financial conditions. Installation costs, along with average quality and good reputation of the manufacturer are of primary importance to this type of buyer.

Making an Economic Analysis

All three types of investors are vitally interested in an economic analysis of an air conditioning system. Perhaps not to the same degree, but these costs must be examined. The investor who makes an investment on a short-term basis is interested from the standpoint of using this analysis as a sales tool in selling his investment. The other two types of investors are even more concerned with the analysis, since it affects their own personal financial picture.

In order to make a complete economic analysis, we must have the following information:

(1) First Cost,
(2) Fixed Charges,
(3) Maintenance Charges, and
(4) Service Charges.

First Cost

First costs include the cost of equipment, piping, ductwork, controls and the labor to install all of these items. Many charts and tables have been prepared in an effort to estimate the first costs of air conditioning systems, but the fact remains that the most accurate method to obtain costs is to prepare a set of plans and secure prices from reputable contractors. It should also be remembered that an estimate on first cost means that the entire economic analysis is also an estimate, since so many of the calculations in the analysis are based on the first cost.

Fixed Charges

Fixed charges consist of amortization, interest on the investment, taxes due to increased value of the building, insurance and rent.

The value of the amortization figure depends upon the first cost and the period over which the investment is to be retired. This amount is then the first cost divided by the number of years over which the amount is to be amortized. Or, designated by a formula:

$$\text{First Cost} \div \text{Years} = \text{Amount in Dollars per Year}$$

Theoretically this amount could be reduced by the amount of interest which it accumulates during the amortization period, but this is taken care of in the interest or investment item.

Interest on the investment is calculated as:

$$[(Y-1) \div 2Y] \ (i) \ (\text{First Cost})$$

where Y = the number of years for amortization, and i=the interest rate. There are some investors who consider this item as negligible, but the fact is that the money must be borrowed or diverted from the owners funds in order to make the installation. Interest on this money is therefore rightfully chargeable to the operation of the system.

Taxes due to the increased value of the building can

be obtained from local tax authorities and will vary depending upon the location of the building.

Insurance premiums will no doubt increase because of the additional coverage required to cover the cost of the air conditioning system. The amount of increase can only be secured by contacting the insurance company who carries the insurance on the balance of the owner's property.

In many cases, sufficient room for the refrigerator equipment or cooling tower is not available in the building and it is necessary to house the equipment in adjacent property. Under these circumstances, any rent paid for this space is chargeable to the operation of the air conditioning system as a fixed charge.

Maintenance Charges

Maintenance charges have usually been estimated as a certain percentage of the installed cost. This is not an accurate method of obtaining maintenance costs, since no two systems have exactly the same type of equipment or the same amount of equipment and labor.

Maintenance charges can be divided into two classifications; preventive maintenance and maintenance repairs.

Preventive maintenance would consist of daily, monthly and yearly inspections and the necessary minor repairs or adjustments to keep the air conditioning equipment in proper operating condition.

The equipment to be maintained can be classified under six general headings:

1. *Rotating Equipment* under which we would place fans, pumps, compressors, motors and some control devices.

2. *Condensing Water Circuit* which would consist of condensers, condenser water piping, cooling towers, spray ponds, float valves, and control valves.

3. *Chilled Water Circuit* under which we would place heat transfer coils, air washers, chilled water piping, shell and tube exchangers, float valves and controls.

4. *Refrigerant Circuit* which would include refrigerant piping, condensers, evaporators, expansion valves, float valves, solenoid valves, relief valves, safety controls and valves.

5. *Self-Contained Units* which consist of a compact air conditioning system built into a cabinet.

6. *Filters and Ducts* would consist of that part of the system which cleans and conveys the air to the various conditioned spaces.

In order to evaluate the cost of preventive maintenance, it is well to itemize the equipment and the work to be accomplished during the inspections. Such a maintenance chart for several types of equipment follows:

MAINTENANCE CHECK CHART

Equipment	Daily	Monthly	Yearly
	ROTATING EQUIPMENT		
Fans (Centrifugal)	1. Check bearings for oil level and temperature. 2. Check fan rotation. (10 minutes)	1. Oil and check alignment of bearings. 2. Check set collars and any unusual wear of bearing. 3. Check belt tension. (30 minutes)	1. Clean fan wheel. 2. Check undue belt wear. Replace belts if excessive wear appears and realign sheaves. 3. Check for any rust spots and clean and touch-up with paint. 4. Check fan shaft for straightness. 5. Check to see that fan wheels are securely fastened to the shaft. 6. Check drive sheaves to see that they are tightly secured. (1 day)
Pumps (Centrifugal)	1. Check packing glands for excessive leakage. 2. Check pump bearing for oil level and temperature. (10 minutes)	1. Oil or grease bearing. 2. Check coupling alignment. 3. Check packing gland for shaft wear. 4. Check and clean strainers. (30 minutes)	1. Check impeller wear and wearing rings. 2. Clean and paint pump housing. 3. Check bearing wear. 4. Check coupling for wear. 5. Replace gaskets. (1 day)
Refrigeration Compressors (Reciprocating)	1. Check suction and discharge pressures. 2. Check oil level in crankcase. 3. Check bearings for temperature rise. 4. Check crankcase sweating. 5. Check for oil leaks. 6. Check for unusual knocks or noises (15 minutes)	1. Check for leaks with Halide torch. 2. Check coupling alignment. 3. Check belt tension. 4. Check high-low pressure cut-off setting. (1 hour)	1. Pump system down and remove heads to check cylinder wear. (Old Machines) (3 Yr. New Machines) 2. Check relief valves and test. 3. Clean strainers, and oil filters. 4. Check unloading devices to see that they unload at the proper pressures. 5. Overhaul compressor every 5 years. 6. Change oil. (2 days)

MAINTENANCE CHECK CHART

Equipment	Daily	Monthly	Yearly
		ROTATING EQUIPMENT, CONTINUED	
Motors	1. Check motor temperature and bearing temperature. 2. Check motor rotation. (10 minutes)	1. Oil or grease bearings. 2. Check arcing of brushes. 3. Check leads to see that connections are secure. 4. Check motor sheave or coupling to see that they are secured to motor shaft. (15 minutes)	1. Clean motor frame and particularly air passages. 2. Check to be sure that motor comes up to speed promptly. 3. Check voltage and amperage at motor. 4. Check motor speed. 5. Check fuse box to see that proper fuses are being used. 6. Check rubber isolators. 7. Check anchor bolts. (2 hours)
		CONDENSER WATER CIRCUIT	
Condensers (Water)	1. Check condition of water for corrosive elements. 2. Check water temperature. 3. Check water pressures. (15 minutes)	1. Take water sample for chemical analysis. 2. Check for leaks with Halide torch. 3. Check for water leaks (1 hour)	1. Drain out all water and clean water side of tubes. 2. Check inside of water passage for corrosion or erosion. 3. Replace any damaged tubes. 4. Replace all gaskets. 5. Check all valves and dismantle and repair if necessary. (2 days)
Starters and Switches	1. Check for arcing on contacts. (10 minutes)	1. Clean contacts. 2. Check lead in wires to see that all connections are tight. (30 minutes)	1. Clean and replace contacts if necessary. 2. Thoroughly clean out all dust and dirt from inside of housing. 3. Check for loose screws and springs. 4. Check all release mechanisms to see that they are in proper working order. 5. Check all fuses and overloads to be sure they are the proper size. (½ day)
Cooling Towers (Natural Draft)	1. Check condition of water for corrosive elements. 2. Check operation of spray nozzles or spray deck. 3. Check float valve operation. (15 minutes)	1. Check pan and interior of tower for algae growth or slime. 2. Take water samples for chemical analysis. (½ hour)	1. Drain and clean pan. Inspect for rust spots, clean and paint. 2. On wood towers, inspect towers for parts needing replacement. 3. For metal towers inspect and treat same as water pan. 4. Repair or replace float valve if necessary. 5. Remove and clean spray nozzles. 6. Check all valves and repair. (2 days)
Cooling Towers (Forced or induced draft)	1. Check condition of water for corrosive elements. 2. Check operation of spray nozzles or spray deck. 3. Check float valve operation. 4. Check fan bearings for oil and temperature. 5. Check fan rotation. (20 minutes)	1. Oil or grease fan bearings. 2. Check pan and interior for algae growth or slime. 3. Take water samples for chemical analysis. (½ hour)	1. Drain and clean pan. Inspect for rust spots, clean and paint. 2. On wood towers, inspect tower for parts needing replacement. 3. For metal towers inspect and treat same as water pan. 4. Repair or replace float valve if necessary. 5. Inspect fan bearings for wear. 6. Remove and clean spray nozzles. 7. Check fan drive. 8. Check all valves and repair. (2 days)
Condenser Water Piping		1. Check for leak repair. (1 hour)	1. Check all valves and repair. 2. Check all piping for rust and corrosion and replace or repair. (1 day)

MAINTENANCE CHECK CHART

Equipment	Daily	Monthly	Yearly
		CHILLED WATER CIRCUIT	
Heat Transfer Coils	1. Check inlet and outlet temperatures, air and water. (30 minutes)	1. Check the condition of the finned surface for dirt accumulation. (30 minutes)	1. At least once a year all coils should be cleaned with an air hose or washed down with a water hose. 2. Check the coil surface for evidence of corrosion. 3. Check coil casings for signs of rust; clean and touch-up with paint. 4. Check the coils for signs of undue wear or erosion and for signs of leaks. (1 day)
Air Washers	1. Check condition of water for corrosive elements. 2. Check operation of spray nozzles. 3. Check float valve operation. (20 minutes)	1. Check pan and interior of washer for any sign of algae growth. 2. Take water samples for chemical analysis. 3. Drain and replace the water in the system. 4. Clean and flush out all drain lines and pumps. (2 hours)	1. Drain and clean the interior of the washer, inspect, clean and paint. 2. Repair or replace float valve. 3. Remove and clean spray nozzles. 4. Remove and clean the eliminator plates. 5. Inspect spray pump as outlined under pumps. 6. Remove and clean all strainer screens and gaskets. 7. Check for evidence of leaks between the casing and the insulation. (3 days)
Shell and Tube Exchangers (Water to Water) (Steam to Water)	1. Check inlet and outlet temperatures. (30 minutes)	1. Check for visible signs of leaks. 2. Take samples of water for chemical analysis. (20 minutes)	1. Drain and dismantle, and clean both sides of heat transfer surface. 2. Check water and steam passages for signs of corrosion. 3. Replace any damaged tubes. 4. Replace all gaskets. 5. Check all valves and dismantle and repair if necessary. (2 days)
Chilled Water		1. Check for leaks and repair. (30 minutes per system)	1. Check all valves and repair. 2. Check all piping for rust and corrosion, and replace or repair. 3. Check all covering for signs of sweating, repair. (2 days per system)
		REFRIGERANT CIRCUIT	
Condensers (Air)	1. Check coil surface to be sure it is clean. 2. Check fan rotation. 3. Check bearing temperatures. (20 minutes)	1. Check for refrigerant leaks with Halide torch. 2. Clean coil surface with compressed air or water. 3. Oil or grease fan bearings. 4. Check alignment of bearings. (2 hours)	1. Check for rust spots on casing, clean and touch up with paint. 2. Clean condenser air fan. 3. Check fan shaft for straightness. 4. Adjust dampers. 5. Oil or grease damper bearings. (1 day)
Condensers (Evaporative)	1. Check condition of spray water for corrosive elements. 2. Check fan bearing for oil and temperature. 3. Check fan rotation. 4. Check operation of spray nozzles. 5. Check float valve operations. 6. Check head pressure at condenser. (30 minutes)	1. Check pan and interior for algae growth and slime. 2. Take water sample for chemical analysis. 3. Check accumulation of lime on coils. 4. Check for leak with Halide torch. 5. Oil or grease fan bearings. 6. Check and clean intake screen. 7. Purge system if necessary. 8. Check belt tension. (2 hours)	1. Drain and clean out water sump. Inspect, clean and paint any rust spots. 2. Remove and clean eliminators. 3. Remove and clean spray nozzles. 4. Check fan shaft and fan wheels. 5. Clean and repaint inside of casing. 6. Check undue wear on belts and sheaves. 7. Check all valves and repair. (2 days)

MAINTENANCE CHECK CHART

Equipment	Daily	Monthly	Yearly
		REFRIGERANT CIRCUIT, CONTINUED	
Evaporators	1. Check inlet and outlet air temperatures. (30 minutes)	1. Check the condition of the finned surface for dirt accumulation. 2. Check for leaks with Halide torch. (1 hour)	1. At least once a year all coils should be cleaned with an air hose. 2. Check the coil surface for evidence of corrosion. 3. Check coil casings for signs of rust; clean and touch-up with paint. (1 day)
Expansion Valves Solenoid Valves Relief Valves Float Valves	1. Check all valves for evidence of sticking. 2. Check operation of all float valves. (30 minutes)	1. Check all connections with Halide torch. 2. Check expansion valve bulb to see that it has good contact with suction line. 3. Remove covers from all control boxes and check all connections. 4. Check operation of all solenoid valves. (2 hours)	1. Pump system down and check the seats of all valves for erosion. 2. Test all relief valves for proper setting. 3. Replace packing in all valves. 4. Replace all gaskets and test for leaks. (2 days)
		SELF-CONTAINED AIR CONDITIONING UNITS	
Self-Contained Units	1. Since most self-contained units are hermetic, inspection becomes a matter of checking conditions being maintained. (20 minutes)	1. Check unit for leaks with Halide torch. 2. Check belts for proper tension. 3. Oil or grease bearings. 4. Check for unusual knocks or noises. 5. Follow the manufacturers instruction in regard to purging. 6. Take condenser sample for chemical analysis. 7. Clean filters if of the cleanable type. (2 hours)	1. Drain the condenser and examine for unusual scale or dirt in condenser tubes. 2. Check contacts and release mechanism on all switches and protective devices and make necessary repairs or replacements. 3. Check the drives for unusual wear and realign and replace belts if necessary. 4. Change throwaway filters 6 times per year. 5. Clean all heat transfer coils with compressed air. 6. Check fan motor in accordance with motor maintenance schedule. (Given under motors). 7. Check all electrical connections to see that they are tight. (1 day per unit)
Window Units or In-The-Wall Units	1. Since all window units and in-the-wall units are hermetic, inspection becomes a matter of checking conditions being maintained. (20 minutes)	1. Check unit for leaks with Halide torch. 2. Check for unusual knocks or noises. 3. Clean filters if of the cleanable type. (1 hour)	1. Remove unit for cleaning. 2. Clean condenser and evaporator coils. 3. Change filters 6 times per year. 4. Check all electrical connections to see that they are tight. (1 day per unit)
		FILTERS AND DUCTS	
Filters (Cleanable)	1. Inspect to see that dust is not leaking through filter joints. 2. Check static pressure across filters. (20 minutes per bank)	1. Clean and oil filters. (10 minutes per filter)	1. Check condition of filter cells to see if they need replacement. 2. Check filter frames for rust spots. Clean and repaint. (½ day per bank)
Filters (Throw-away)	1. Inspect to see that dust is not leaking through filter joints. 2. Check static pressure across filters. (20 minutes per bank)	1. Change filters every 2 months. (2 minutes per filter)	1. Check filter frames for rust spots. Clean and repaint. (½ day per bank)
Ducts		1. Inspect to see if trace of moisture between insulation and surface of ducts. (30 minutes per system)	1. Inspect for defects and leaks. 2. Inspect for excess accumulation of dirt and clean if necessary. (½ day per 100 feet for cleaning)

Maintenance repairs require a knowledge of the life span of the equipment used on an air conditioning system. Naturally, the costs are not going to be as much during the first years of operation as they will be after the equipment has operated for a number of years. The recommended procedure is to calculate the cost over a period of, say, 20 years, and then average it for each year of operation.

By preparing tables giving the equivalent replacement value of the different types of equipment and using this as a reference, the cost of maintenance repairs can be evaluated. The following are typical of such tables:

Item	Equivalent Replacements	Percent of Original Cost (Per 20 Years)
RECIPROCATING COMPRESSORS		
1. Compressor	1 in 20 years	110% (Cleanable)
2. Motors	1 in 20 years	140% (Non-Cleanable)
3. Condensers (Cleanable)	1 in 20 years	
4. Condensers (Non-Cleanable)	2 in 20 years	
5. Refgrigerant Charge	2 in 20 years	
6. Oil Changes	4 in 20 years	
7. Paint	Paint 4 times in 20 years	
RECIPROCATING WATER CHILLERS		
1. Compressor	1 in 20 years	110% (Cleanable)
2. Motors	1 in 20 years	140% (Non-Cleanable)
3. Condensers (Cleanable)	1 in 20 years	
4. Condensers (Non-Cleanable)	2 in 20 years	
5 Refrigerant Charge	2 in 20 years	
6. Oil Changes	4 in 20 years	
7. Valves and Controls	2 in 20 years	
8. Paint	Paint 4 times in 20 years	
CENTRIFUGAL COMPRESSORS		
1. Compressor Assembly	1/2 in 20 years	70%
2. Motor	1 in 20 years	
3. Purge Units	2 in 20 years	
4. Oil Pump Motors	2 in 20 years	
5. Condensers	2/3 in 20 years	
6. Chillers	2/3 in 20 years	
7. Gaskets	3 sets in 20 years	
8. Refrigerant Charge	1 in 20 years	
9. Oil Changes	2 in 20 years	
10. Paint	Paint 4 times in 20 years	
INDIVIDUAL FAN-COIL UNITS AND INDUCED AIR UNITS		
1. Casings	1/2 in 20 years	60%
2. Coils	2/3 in 20 years	
3. Fan Motors	2 in 20 years	
4. Filters (Cleanable)	1 set in 20 years	
5. Filters (Throwaway)	Change every 2 months	
6. Filter Oil (For Cleanable Type Only)	1 gallon per filter per 20 years	
7. Switches	3 in 20 years	
8. Paint	Paint 3 times in 20 years	

Item	Equivalent Replacements	Percent of Original Cost (Per 20 Years)
AIR-HANDLING UNITS		
1. Casings	1/2 in 20 years	60%
2. Cooling Coils	2/3 in 20 years	
3. Heating Coils	2/3 in 20 years	
4. Humidifiers	4 in 20 years	
5. Fan Motors	1 in 20 years	
6. Fan Bearings	2 in 20 years	
7. Fan Shaft	1 in 20 years	
8. Filters (Cleanable)	1 set in 20 years	
9. Filters (Throwaway)	Change every 2 months	
10. Filter Oil (For Cleanable Type Only)	1 gallon per filter per 20 years	
11. V-Belts	2 sets in 20 years	
12. Dampers	1 in 20 years	
13. Valves and Controls	2 in 20 years	
14. Paint	Paint 4 times in 20 years	
COOLING AND HEATING COILS		
1. Cooling Coils	2/3 in 20 years	66%
2. Heating Coils	2/3 in 20 years	
EVAPORATIVE CONDENSERS		
1. Casings (Not H.D.G.)	2 in 20 years	160%
2. Casings (H.D.G.)	1 in 20 years	
3. Coils	2/3 in 20 years	
4. Fan Motors	1 in 20 years	
5. Pump	1 in 20 years	
6. Pump Motors	1 in 20 years	
7. Fan Bearings	2 in 20 years	
8. Fan Shaft	1 in 20 years	
9. V-Belts	2 sets in 20 years	
10. Sprays	3 sets in 20 years	
11. Receivers	1 in 20 years	
12. Dampers	1 in 20 years	
13. Air Intake Screens	2 in 20 years	
14. Paint for Casings	Paint every 2 years	
SELF-CONTAINED UNITS		
1. Reciprocating Compressors	1 in 20 years	110% (Cleanable)
2. Compressor Motors	1 in 20 years	140% (Non-Cleanable)
3. Fan Motors	1 in 20 years	
4. Fan Bearings	2 in 20 years	
5. Cooling Coils	2/3 in 20 years	
6. Heating Coils	2/3 in 20 years	
7. Refrigerant Charge	2 in 20 years	
8. Oil Changes	4 in 20 years	
9. Condensers (Cleanable)	1 in 20 years	
10. Condensers (Non-Cleanable)	2 in 20 years	
11. Filters (Cleanable)	1 set in 20 years	
12. Filters (Throw-away Type)	Change every 2 months	
13. Filter Oil (For Cleanable Type Only)	1 gallon per filter per 20 years	
14. V-Belts	2 sets in 20 years	
15. Valves and Controls	2 in 20 years	
16. Paint for Casings	Paint 4 times in 20 years	
WINDOW AND IN-THE-WALL UNITS		
Complete Unit	Replace every 10 years	200%

Item	Equivalent Replacements	Percent of Original Cost (Per 20 Years)
FANS		
1. Casings	½ in 20 years	60%
2. Bearings	2 in 20 years	
3. Shaft	1 in 20 years	
4. Fan Motor	1 in 20 years	
5. Inlet Vanes or Dampers	1 in 20 years	
6. V-Belts	2 sets in 20 years	
7. Paint	Paint 4 times in 20 years	
COOLING TOWERS		
1. Casing	1 in 20 years	110%
2. Fans	1 in 20 years	
3. Fan Motors	1 in 20 years	
4. Sprays	3 sets in 20 years	
5. Paint	Paint every 2 years	
PUMPS		
1. Pump Housings	½ in 20 years	66%
2. Impellers	1 in 20 years	
3. Packing Glands	3 in 20 years	
4. Motors	1 in 20 years	
5. Paint	Paint 4 times in 20 years	
STEAM, WATER AND REFRIGERANT PIPING		
1. Black Iron Pipe	5% per year	
2. Galvanized Iron Pipe	3% per year	
3. Wrought Iron Pipe	2% per year	
4. Copper Pipe	2% per year	
ELECTRICAL WIRING		
1. Equipment Wiring	4% per year	
2. Control Wiring	2% per year	
3. Electrical Temperature Controls	10% per year	
4. Motor Starting Equipment	1 in 20 years	
5. Switches	1 in 20 years	
VALVES		
1. Temperature Control Equipment	10% per year	
2. Shut-off Valves	3% per year	
3. Refrigerant Expansion Valves	10% per year	
4. Refrigerant Solenoid Valves	10% per year	
ISOLATORS		
1. Isolators (Spring)	1 in 20 years	
2. Isolators (Rubber)	2 in 20 years	
MISCELLANEOUS		
1. Light Oil	1 gallon per bearing per 20 years	
2. Heavy Oil	½ gallon per bearing per 20 years	
3. Grease	2 pounds per bearing per 20 years	
LABOR COST FOR REPLACEMENTS		
1. Light Equipment and Piping	Figure 50% of Equipment Cost	
2. Heavy and Costly Equipment	Figure 40% of Equipment Cost	

As an explanation of some of the items and the terms used in preceding tables, it is not necessarily meant that the items noted would need complete replacement in the time noted, but that the repairs and cost of parts to be replaced would be equivalent to the cost of replacements at the rates given.

Using the information from the preventive maintenance and maintenance repair tables it is possible to calculate the cost of maintenance for a twenty year period, and then obtain the yearly average.

Service Charges

Annual service charges include such items as electric power, fuel, steam for reheat, water makeup for towers or condensing equipment, sewer charges and miscellaneous items.

The cost of electric power for operating the fans, pumps, refrigeration equipment and controls can be calculated from the power rates, the brake horsepower of the equipment and the estimated number of hours of operation at full load, by using the following formula:

$$(1)\ \text{Power Cost} = A \div \text{Motor Efficiency}$$

where $A = 0.746 \times$ bhp per ton $\times$ tons of refrigeration $\times$ equivalent full load hours $\times$ cost per kw-hr.

The power cost should be calculated for each item of equipment since the hours of operation and the motor efficiency will not be the same for all equipment. For example, the fan and circulating pump motors will no doubt be operating at full load whenever the air conditioning system is in operation, whereas the refrigeration equipment will require only enough power to supply the refrigeration load.

For fan and pump motor power cost, the formula can be simplified as follows:

$$(2)\ \text{Power Cost} = B \div \text{Motor Efficiency}$$

where $B = 0.746 \times$ bhp $\times$ hours of operation $\times$ cost per kw-hr.

Fuel costs for operation of diesel engines or gas engines for driving refrigeration compressors can be calculated from the pounds of fuel required per bhp, the equivalent full load hours of operation and the cost per pound or per cubic foot of fuel used.

$$\text{Fuel Cost} = C \div \text{Hp-hr per Unit Fuel}$$

where C=Avg. bhp per ton $\times$ tons of refrigeration $\times$ equivalent full load hours $\times$ unit fuel cost.

The cost of steam for reheat is difficult to calculate with any degree of accuracy since the outside humidity as well as temperature will affect its requirements; however, by calculating the number of hours that the system will be on partial load as compared to the equivalent full load hours used for calculating power costs, the cost of steam can be evaluated.

$$\text{Steam Cost} = D \div 1000$$

where D=Avg. lb steam per hr $\times$ hours of partial load operation $\times$ cost per 1000 lb steam.

OWNING AND OPERATING COST SHEET

Job Name: ..... Location: .....

Cost of Mechanical System	$.....
Other Costs	$.....
First Cost—Total (FC)	$.....

ANNUAL FIXED CHARGES

Amortization-Depreciation Period Y = Years	
Interest Rate i%	
Amortization & Depreciation $\frac{FC}{Y}$ =	
Interest $\frac{Y-1}{2Y} \times i \times FC$ =	
Taxes	
Insurance	
Rent	
Total Annual Fixed Charges	

ANNUAL MAINTENANCE COSTS

Replacement of Parts	
Replacement of Piping	
Replacement of Electrical Wiring	
Labor for Above	
Filter Maintenance	
Oiling and Greasing	
Painting	
Refrigerant	
Water Treatment	
Labor for Operation of System	
Total Annual Maintenance Costs	

ANNUAL SERVICE COSTS

Electric Power Cost:	
Fans	
Pumps—Chilled Water	
Pumps—Condenser Water	
Pumps—Well Water	
Cooling Tower—Fans	
Cooling Tower—Pumps	
Refrigeration Machines	
Gas	
Coal	
Oil—Boilers or Diesels	
Steam:	
Direct Heating	
Ventilation—Preheaters	
Ventilation—Reheaters	
For Turbines	
For Absorption Machines	
Sewer—Service Charge	
Condenser Water Make-Up	
Miscellaneous	
Total Annual Service Costs	

SUMMARY

Total Annual Fixed Charges	$.....
Total Annual Maintenance Costs	$.....
Total Annual Service Costs	$.....
Total Annual Owning and Operating Costs	$.....

Water make-up for towers, evaporative condensers or spray ponds can be readily calculated by knowing the equivalent full load hours of operation and the water cost. This item can be calculated as follows:

(1) Water Cost = E ÷ 8330

where E = 12 × tons of refrigeration × equivalent full load hours × cost per 1000 gallons.

In cases where city or well water is used for condensing purposes the cost can be calculated as follows:

(2) Water Cost = F ÷ 1000

where F = 60 × gpm per ton × tons of refrigeration × equivalent full load hours × cost per 1000 gallons.

In many cities, owners must pay for sewer connections for air conditioning waste water. This is especially true where well water is used for condensing purposes and is then dumped into the sewer. The charge is usually based on the number of gallons of water used and varies from city to city. It is therefore necessary to obtain this item from local city officials.

Under miscellaneous would be placed such items as permits, license fees, etc. These would be determined for each installation by local ordinances.

When all items have been calculated they can be assembled on a summary sheet to give a clear and comprehensive picture of the total annual owning and operating costs. A typical cost sheet is presented above.

Condensation Control Design

for an Indoor Heated Pool

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Design procedure for enclosed heated pools intended for hydrotherapy, where water temperatures may normally vary from 92 to 96 deg. Steps in design may also be used for heated indoor pools used for recreation.

DURING the past decade there has been increased use of heated pools for year round swimming, and as hydrotherapy for many types of infirmities. Numerous such installations have been made.

In general, these facilities are completely enclosed resulting in severe condensation problems due to the elevated water temperatures up to possibly 100 deg F as may be required for some therapeutic use.

Mechanical problems of indoor heated pools have created many difficulties in design. Often the designs have resulted in unsatisfactory conditions due to constantly wet walls, dripping ceiling, fogged windows, and environmental conditions that are far from being suitable. Therefore, when the problem arose of providing facilities for a totally enclosed therapeutic pool, the course approved was to thoroughly analyze the problem without reference to any existing pool in an attempt to provide the required 92 to 96 degree water and air temperatures, with no visible condensation on walls, ceiling, or glass.

In the design to be discussed, which can be taken as an example of design steps to follow, the pool was to be housed in a 46 x 14½ x 7½ ft high structure with a small extension housing the heating boiler and pool equipment.

Architectural treatment of the building used as a design example provided for a wall construction consisting of 8 and 4-inch brick separated by a 2-inch air space. Roof construction was concrete slab with 2 inches of insulation, penetrated by two "sky domes." Windows consisted of projected aluminum sash. Special note should be taken that the roof requires vapor sealing of such type as to prevent the roofing from blistering from the excessive vapor pressure below the slab, thus possibly losing its watertight integrity. Two layers of 15 lb roofing felt mopped into the built up roofing will accomplish this.

Design Considerations

The initial step in determining the mechanical treatment of the pool building is to determine the inside surface temperatures of the wall, roof, and windows in order to recommend modifications or changes in the proposed building materials to minimize surface condensation. An outside design temperature of 0 deg was used with the previously established inside design of 92-96 deg.

After evaluating various combinations of materials the walls and roof proved to have good surface temperature characteristics with the previously mentioned construction. All windows were specified to be double glass with ¼ inch air space between panes. With these conditions, the surface temperatures, as calculated, were: Walls, 78.3 deg, roof, 85.8 deg, and glass, 58 deg. These calculations established the dew point criteria for design purposes.

The establishment of a limiting 58 deg dew point with the previously established 92 deg room and water temperature fixes the relative humidity of the space at 32%. After assuming a 25 fpm air velocity over the water surface, we can obtain the heating effect and the natural evaporation of the water from the following formula:

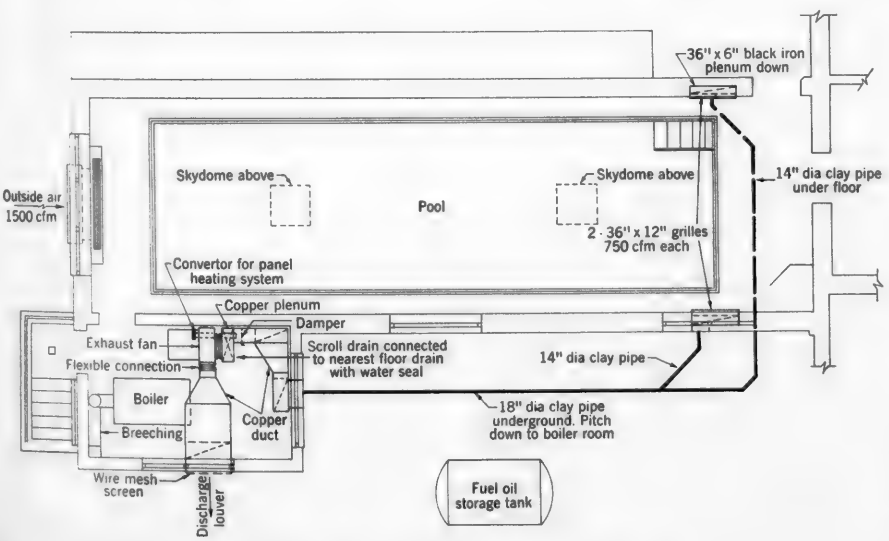


Fig. 1. Plan of pool house and boiler room for enclosed pool described in article.

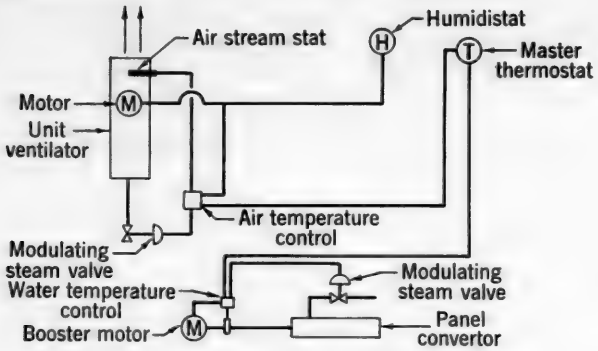


Fig. 2. Control diagram for enclosed pool.

$$Q = (95 + 0.425\,V)\ (e_w - e_a)$$

where Q = Btu transmission by evaporation from water surface per hour per square foot of surface.
V = Velocity of air over water surface, fpm.
e_w = Vapor pressure in inches of mercury corresponding to the water temperature.
e_a = Vapor pressure of moisture in the air.

Inserting the proper values in the formula results in evaporation heat emission of approximately 100 Btu per hr per sq ft per inch of vapor pressure difference between the water and the air. The vapor pressure corresponding to the 92 deg water temperature is 1.51 inches. The vapor pressure of the moisture in 92 degs F, 32% RH air is 0.48 inch. The net evaporation heat loss from the 430 sq ft pool is

$$100 \times (1.51 - 0.48) \times 430 = 44{,}500 \text{ Btu per hr}$$

This heat will be lost to the air and in order to maintain the water at the proper temperature this heat loss plus a conduction loss to the ground must be made up by the pool heating system. Radiation losses are small if surface temperatures are close to water temperature and may be ignored. For the specific example being studied, a conduction loss from the bottom and sides of 5 Btu per sq ft from pool to ground was assumed, bringing the total pool heating requirements up to 49,000 Btu per hr. Building direct radiation losses totalled 45,000 Btu per hr so it would appear that no building heating would be required. This is a misleading circumstance, however, since in order to limit the ambient RH, the moisture being evaporated from the pool and consequently the heat it contains must be removed by the ventilating system. The design of the heating system, therefore, provided for meeting 80% of the direct radiation losses by means of a ceiling panel which, in addition to its primary purpose, positively prevented condensation on the ceiling and skydomes, and at the same time raised the surface temperatures of the walls and glass above their previous calculated values. Possibility of additional heating was also provided in the ventilation system.

The ventilation, of course, is the key to condensation prevention and in order to allow a safety factor, the radiant effect of the ceiling panel on the walls and glass were ignored. The surface temperature and design dewpoint for ventilation calculations remain at the previously estimated 58 deg.

The evaporation equivalent of 44,500 Btu per hr. is 300,000 grains per hour, using a latent heat of 1040 Btu per lb.

If the entering air is assumed to contain 30 grains per lb (35 DP), and the ambient condition is to be maintained at 58 DP (72 grains per lb) the ventilation rate must be:

$$\frac{300{,}000}{(60 \times 0.75)\ \ (72 - 30)} = 1{,}550 \text{ cfm}$$

In this equation hours are converted to minutes and the density of air is 0.75 lb per cubic foot.

Utilizing this ventilation rate, there results 20 air changes per hour. This rate prevents condensation on the walls and glass with 0 deg. outside conditions. The radiant effect of the ceiling panel provides the safety factor for condensation control.

Figure 1 presents a diagrammatic arrangement of the mechanical equipment. A standard classroom type ventilator using 100% outdoor air was utilized for ventilation. The heating coil was selected to enable it to carry part of the heating load if necessary. Note the top discharge and the location of the exhaust grilles with underground duct connections of clay tile pipe. This arrangement provides the proper circulation without drafts and with no visible ductwork.

Figure 2 is a schematic diagram of the control system. The unit ventilator and the ceiling panel are controlled by a master room thermostat, an air stream thermostat and a humidistat. The air stream stat located in the unit ventilator discharge is normally set for 92 deg. and controls the steam valve in the supply line. The master thermostat controls the temperature of the radiant panel by resetting the water temperature controller at the convertor. If the maximum 150 deg water temperature does not satisfy the master room thermostat, the air stream stat is automatically reset to a higher air discharge temperature to meet the heating demand. If the room temperature rises above 96 deg. after the panel steam valve has been closed by action of the water temperature controller, the air stream stat is automatically reset downward until the required temperature is met. The unit ventilator operates continuously at all times when the relative humidity in the room rises above 30% or when the thermostat calls for additional heating or cooling through resetting of the air stream stat.

An important consideration in the design of a heated pool installation is the heating system selected for the pool water. For relatively high temperature pools similar to the type described, care must be taken to limit the entering water temperature so as not to cause possible dis-

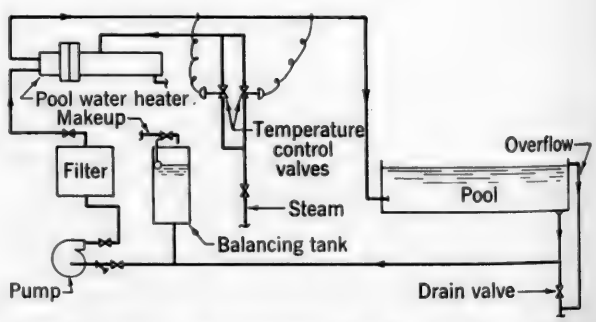


Fig. 3. Schematic arrangement for pool heating system.

comfort to the users. With the high ventilation rate necessary for condensation control, the heating load on the pool water heaters is increased, thereby aggravating the problem. The simplest positive means of limiting the entering temperature is by increasing the circulation rate, thus minimizing the required water temperature differential. For the design of the pool described previously, the method of pool heating shown in Fig. 3 was adopted and has proved successful. The two parallel steam valves for the pool heater have their sensing elements in the water leaving the heater. The high setting for the case in point was 96 deg., the minimum allowable circulation rate being selected to provide 92 deg water leaving the pool under design conditions. Two steam valves are used, one to provide quick fill capability while heating the water up to 90 deg at start-up, the other valve to pick up the load from that point. Water enters the pool via a peripheral supply pipe approximately two and one half feet below the normal water line and returns to the heater and filter through the main drain connection.

The pool has met all expectations as designed over the past two-year period with no condensation in evidence and satisfactory control of water temperature at all times.

Papers Presented at ASHAE Semi-Annual Meeting

The June Semi-Annual Meeting of the American Society of Heating and Air-Conditioning Engineers, held in the Pick-Nicollet Hotel, Minneapolis, Minn., consisted of five sessions during which nine papers were presented and two symposia conducted.

Following are descriptions of some of the papers:

Water-Cooled Luminaire in a Panel-Air System, by W. F. Spiegel, staff engineer, C. S. Leopold Engineers, Philadelphia, Pa., described a series of tests and data showing the heat transfer mechanism and the performance of water-cooled fluorescent light fixtures operating as cooling panels in a suspended metal ceiling. It is found that when water at an average of 9 deg F below room temperature is circulated through the water-cooled light fixture, the equivalent of 100% of the energy supplied to the lights is transferred to the water. The amount increases as the water temperature is further depressed. An energy balance indicates that the data are accurate within the range of good air-conditioning load analysis.

Pulsations in Residential Gas Furnaces with Multiple-Port Burners, by A. A. Putnam, assistant division chief, Battelle Memorial Institute, Columbus, Ohio, was the third of a series of reports presenting results obtained from a study of combustion noise problems in oil- and gas-fired residential heating and equipment. This research is sponsored jointly by ASHAE, The American Gas Association, and Oil Heat Institute, and conducted by Battelle Memorial Institute. This paper outlines the known or self-evident mechanism whereby oscillations may or may not exist, providing a basis for a subsequent paper on engineering applications of this theory. Based on observation, a description is given of a logical basic mechanism of combustion-driven oscillations in furnaces equipped with multiple-port, slot, or ribbon burners.

Evaluation of Air Cleaners for Air Conditioning and Ventilation, Part I—Apparatus, by K. T. Whitby, assistant professor; A. B. Algren, professor; R. C. Jordan, professor and head; and J. C. Annis, research fellow, all of the Mechanical Engineering Department, University of Minnesota, Minneapolis, is the first of three covering four years of work. It describes apparatus and procedures for evaluating air conditioning and ventilating type air cleaners and is the result of research sponsored by the Society in cooperation with the University and the U. S. Public Health Service. *Part II* will describe the application and evaluation for arrestance testing of air cleaners and *Part III* will cover applications to determine the life characteristics of air cleaners.

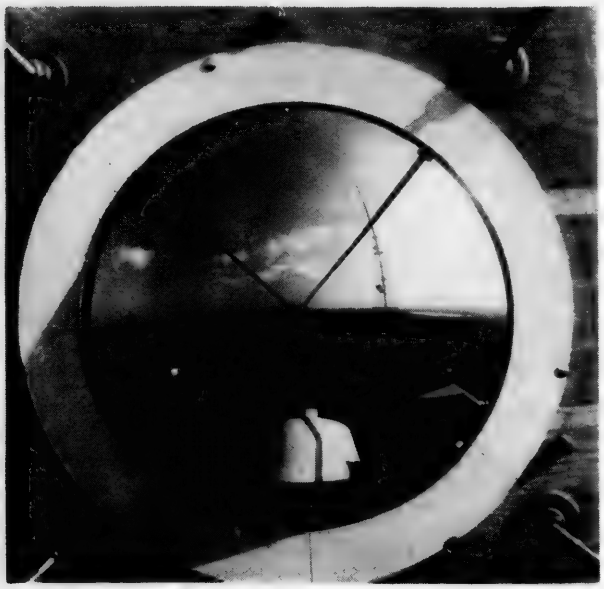
Winter Infiltration through Swinging-Door Entrances in Multi-story Buildings, by T. C. Min, associate professor, Mechanical Engineering Department, Alabama Polytechnic Institute, Auburn, Ala., and former research engineer, ASHAE Research Laboratory, resulted from research carried out by the ASHAE Technical Advisory Committee on Heating and Air-Conditioning Loads. Presented were results of both field and laboratory tests under winter heating conditions. Also given were the procedure and necessary data to calculate entrance infiltration and an approximate general equation for the calculation of infiltration.

Corrosion Inhibition of Tubes in Low-Pressure Steel Boilers, by W. A. Keilbaugh, head of the Chemical Section, and F. J. Pocock, senior chemist, both of the Babcock and Wilcox Company, Research Center, Alliance, Ohio, was a progress report of a test program investigating methods for alleviating water-side corrosion in low-pressure, steel, fire-tube boilers. The program was started in the latter part of 1954 and the paper presented what was done from then to April, 1957. The authors are continuing their study with particular emphasis on how water hardness constituents influence inhibitor effectiveness. One other low alloy steel is also under test, and attention is being given to boiler storage problems.

Cooling Load from Pretabulated Impedances, by Harry Buchberg, associate professor of engineering, Department of Engineering, University of California, Los Angeles, offers a method for computing cooling loads by using the pretabulated complex impedance characteristics of a typical wall construction. The paper is the result of research sponsored by the Society in cooperation with the University. A comparison is made between the solution of a thermal network which represents the heat transfar paths in a one-room frame dwelling based on sinusoidal steady state inputs, and a more exact solution obtained by using a d-c network computer.

Solar Energy Utilization For Heating, Cooling, Distillation and Drying was prepared by the ASHAE Technical Advisory Committee on Solar Energy Utilization. This paper showed, broadly, the technical information needed in the solution of solar utilization problems. A literature search before research projects are undertaken was advised because of the nation-wide interest in solar energy utilization. This Committee is comprised of members from Malaya, Israel, Sweden, India, Canada, and the United States.

The 65th Annual Meeting of the Society will be held in Philadelphia, Pa., January 26-29, 1959.



View to East . . .

. . . and West

from Blue Hill Observatory, Milton, Mass., where four years of measurements of solar radiation by the observer in charge, U.S. Weather Bureau's Solar Radiation Observing Station, has resulted in this comprehensive report and analysis of . . .

Solar Radiation on Walls Facing East and West

CHARLES V. CUNNIFF

U. S. Weather Bureau, Blue Hill Observatory, Milton, Mass.

MEASUREMENTS of solar radiation on the vertical surfaces facing East and West at Blue Hill Observatory were begun in September, 1952, and ended in August, 1956.

Unit of measurement is the langley; its dimensions are gram-calorie per square centimeter. Eppley pyrheliometers used in the vertical measurements were calibrated with Eppley standard pyrheliometers, or with the Smithsonian silver disc pyrheliometer. Measurements were recorded on either Leeds and Northrup, or Brown recorders.

Charles V. Cunniff is a graduate of Northeastern University, Boston, Mass., and entered Government service at Mt. Washington, N. H., in 1946 after serving three years in the Army Air Force. He was transferred in 1951 to the solar radiation section of the Weather Bureau, and since 1953 has been observer in charge of the Bureau's Solar Radiation Observing Station at Blue Hill Observatory, which is located in Milton, Mass.

Photos in headpiece were taken with a whole sky camera, and show the type of topography to the East and West, and the terrestial obstructions to the free path of solar radiation from those quadrants. The white cylindrical objects at the bottom of the photos are shields enclosing the pyrheliometers, with the outer edge of the shields mounted parallel to the receiving surface of the bulb. To the right foreground of view to East is a television transmitter building and tower, whose effect on ground reflectivity is discussed later.

Tables 1 and 2 show the mean annual distribution of the daily values of solar radiation received on the vertical surfaces facing West and East respectively. On the East surface on 30% of the days, radiation values ranged from 0 to 100 langleys, as compared to 28% on the West vertical surface. During the month of December, there were no instances in which values on either surface exceeded 200 langleys per day. On the West vertical surface three days per year had values between 500 and 600 langleys, while such high mean values have not been measured on the East surface. Ninety-six days of the year showed values greater than 300 langleys on the

TABLE 1—MEAN NUMBER OF DAYS PER YEAR WITH RADIATION FALLING, IN GIVEN INTERVALS, ON A VERTICAL SURFACE FACING WEST.

Interval, Langleys per day	Month													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	%
	Days per year on West vertical surfaces													
0-100	17	12	11	9	4	1	2	3	4	9	14	16	102	28
100-200	11	6	4	6	6	5	4	5	5	8	14	15	89	24
200-300	3	9	8	3	8	6	8	9	10	12	2		78	21
300-400		1	7	6	5	10	9	9	9	2			58	16
400-500			1	6	7	7	8	4	2				35	10
500-600					1	1		1					3	1

TABLE 2—MEAN NUMBER OF DAYS PER YEAR WITH RADIATION FALLING, IN GIVEN INTERVALS, ON A VERTICAL SURFACE FACING EAST.

Interval, Langleys per day	Month													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	%
	Days per year on East vertical surfaces													
0-100	17	12	12	9	6	2	2	5	6	10	13	16	110	30
100-200	11	5	3	6	5	7	5	6	8	7	12	15	90	25
200-300	3	10	8	5	6	5	6	7	10	13	5		78	21
300-400		1	7	9	9	11	12	13	6	1			69	19
400-500			1	1	5	5	6						18	5

West surface, while only 87 days had similar values on the East.

Figures 1 and 2 show the hourly distribution of radiation on the East and West vertical surfaces during cloudless days at four times of the year: summer and winter solstices, and vernal and autumnal equinoxes. Peak intensities occur during the equinoxes, for near sunrise and sunset at these dates, the sun's rays are more nearly at normal incidence to the receiving surface than at any other time of the year. The maximum occurred with the sun above the horizon rather than on the horizon on these dates, due perhaps to the decreasing length of the path of the radiation through the atmosphere with increasing solar elevation. The daily totals are greater during the summer solstice due to the longer solar day. The curve for the winter solstice reflects the shortened solar day. With the sun rising well south of the East surface (125 degrees azimuth), its rays are far from being normal to the receiving surface of the bulb.

After solar noon in all cases, diffuse sky radiation from half of the sky, and that radiation reflected from the ground constitute all of the radiation received on the East vertical surface. At the same time the West vertical surface is receiving, besides the diffuse sky radiation and that reflected from the ground, the radiation which impinges upon it directly. The peak instantaneous value occurs on the East surface during the summer solstice about 7:30 am; during the equinoxes about 8:30 am; and during the winter solstice about 9:30 am. The corresponding peaks on the West surface occur about 4:30 pm; 3:30 pm, and 2:30 pm respectively. The diffuse and ground reflected components impinging on the West surface during the morning and on the East in the afternoon constitute approximately 10 to 15% of the respective daily totals during cloudless days. Figures 3 and 4 indicate the average daily totals of solar radiation on the vertical surfaces East and West for the cloudless days of the year. These curves, drawn by eye

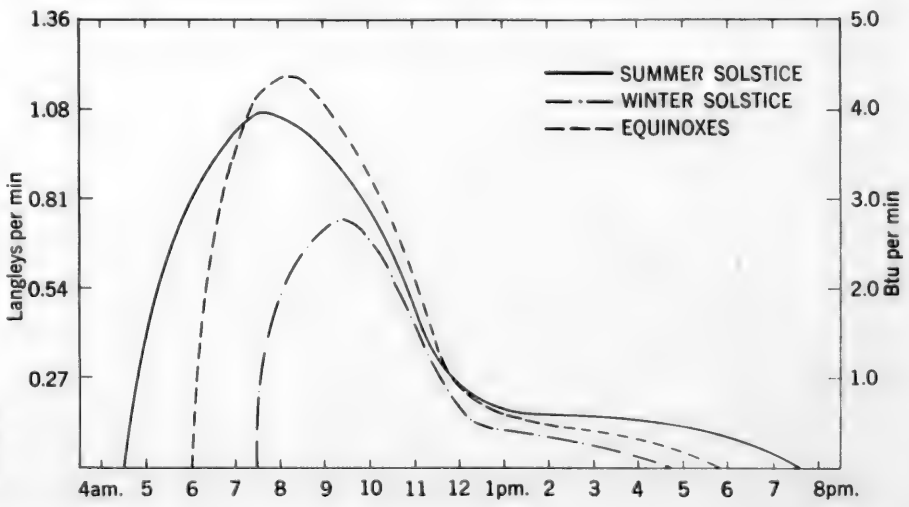


Fig. 1. Average hourly values of solar radiation received on an East vertical surface at solstices and equinoxes.

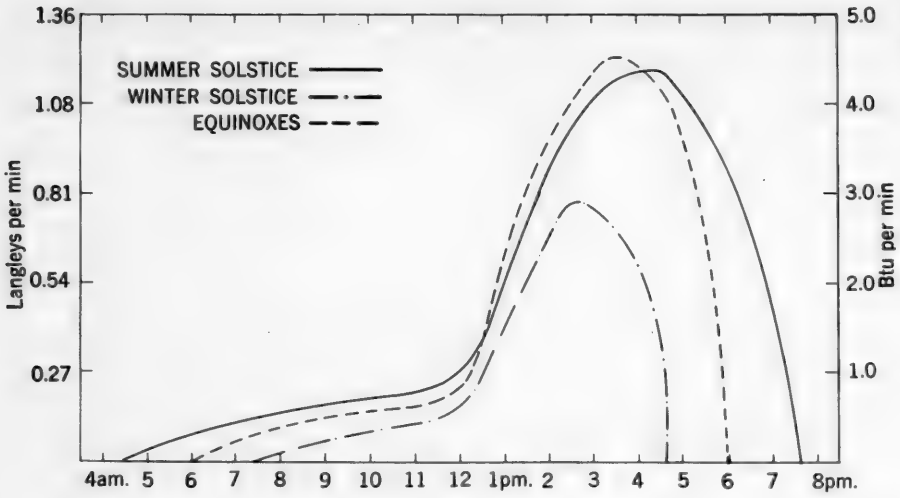


Fig. 2. Average hourly values of solar radiation received on a West vertical surface at solstices and equinoxes.

for best fit, were obtained by averaging observations of all clear days and interpolating for dates on which no clear days occurred. For each chart, 86 cases of clear skies was the basis for the curve. The greatest number of clear days was in October with a total of 18. A comparison of the two curves shows that during the Fall and Winter months the curves are similar. However the radiation received on the West surface in summer (May, June, July and August) appears to be about 25 langleys per day higher than that received on the East surface. The peak intensity on the East surface occurred about May 15, while on the West it was June 15. Possibly a greater number of observations of cloudless day radiation would eliminate these differences.

Figures 5 and 6 indicate the ratio of the daily totals of vertical surface radiation East and West respectively to the daily total of radiation received on a horizontal surface during cloudless days. Solar elevation at noon was used as the abscissa to indicate, to some extent, the time of the year. With low noon solar elevations, during the winter months, the amount of variability is great, possibly due to the reflectivity of snow cover or lack of

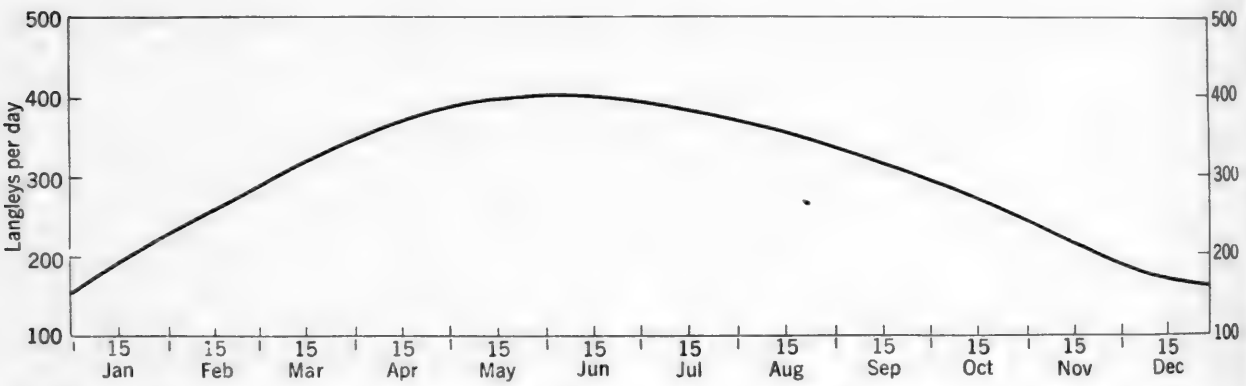


Fig. 3. Average daily values of solar radiation received on a vertical surface facing East during cloudless days.

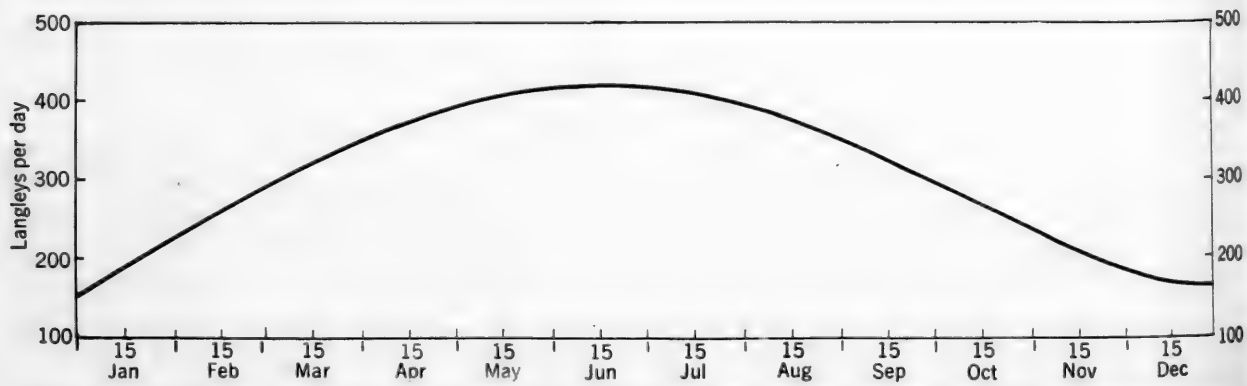


Fig. 4. Average daily values of solar radiation received on a vertical surface facing West during cloudless days.

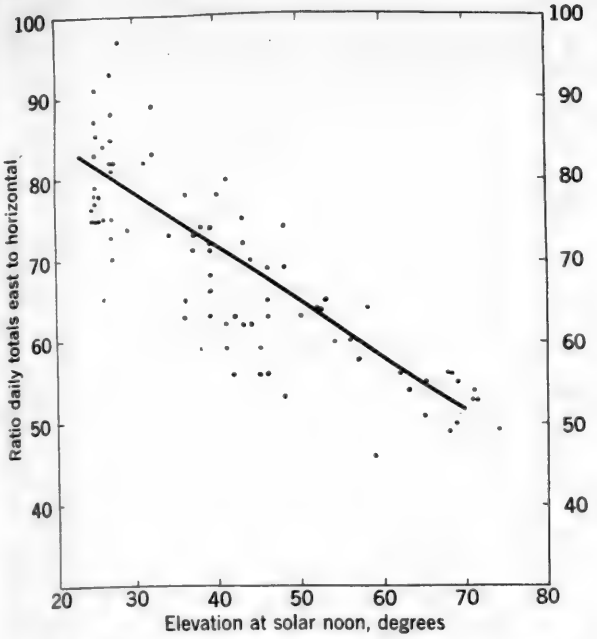


Fig. 5. Ratio of the daily total of radiation received on a vertical surface facing East to the daily total of radiation received on a horizontal surface during cloudless days.

it, tending to influence greatly the vertical radiation, and having only a slight effect on the horizontal radiation. During the spring and fall there is a great difference between the ground surfaces from day to day, and this may contribute markedly to the degree of scatter in the

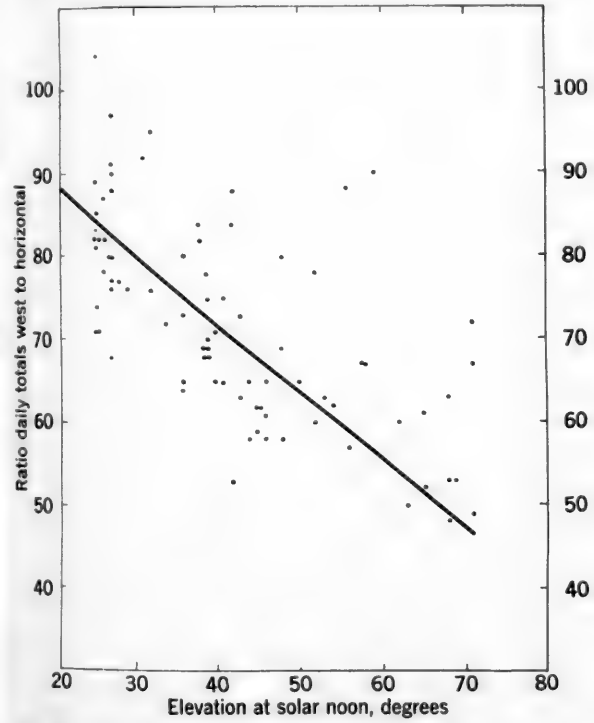


Fig. 6. Ratio of the daily total of radiation received on a vertical surface facing West to the daily total of radiation received on a horizontal surface during cloudless days.

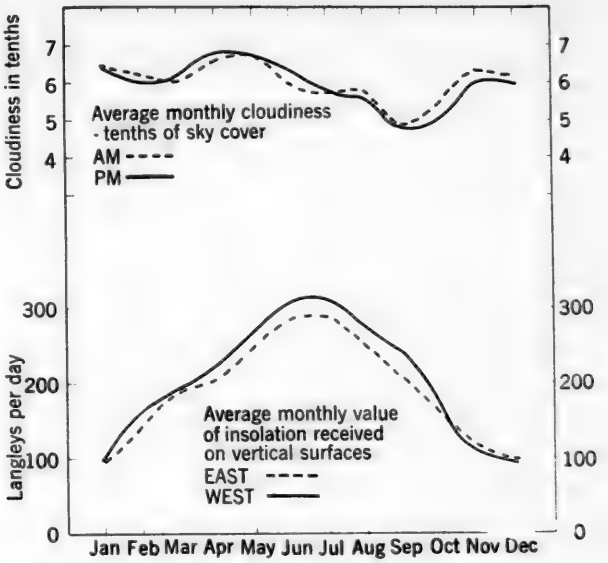


Fig. 7. Average monthly values of radiation received on vertical surfaces facing East and West; also, average monthly amounts of cloudiness, in tenths of sky cover, during the morning and afternoon.

above figures. Possibly seasonal variation in foliage of deciduous trees in the neighborhood may contribute to the variability; also errors may be due to small numbers which introduce relatively large percentage errors. The ground surface to the west is, for the most part, covered by deciduous trees interspersed with a few conifers, while to the east a new television transmitter building and tower antenna, built in 1954, have served to change materially the effect of ground reflectivity in that quadrant.

During cloudless days the original radiation trace was interpolated for values affected by the TV tower, but no alteration of values could be attempted for the change in ground reflectivity characteristics due to the new building.

With curves drawn by eye for best fit, the maximum ratio occurs, in both cases, with low solar altitudes, because of the more favorable angle of incidence on the vertical surfaces.

Figure 7 represents the average monthly values of radiation received on the vertical surfaces facing East and West, together with the average monthly amounts of morning and afternoon cloudiness in tenths of sky cover.

The radiation values on the East surface ranged from a low of 96 langleys per day in December to 286 langleys per day in June and July, with the corresponding values on the West surface, 95 and 313. For practically the entire year, the West vertical surface received a greater amount of radiation than the East.

Tables 3 and 4 are the monthly means of daily values for the period of record, and are the basis for Fig. 7.

Figures 8 to 12 constitute traces of radiation received in langleys per day on three surfaces for various cloud amounts. Only those days in which cloud cover was constant for the entire day were used in constructing these charts.

Figure 8 is a trace of the radiation received with cloud covers of zero to three-tenths. As in the case of most

TABLE 3—MONTHLY MEAN VALUES OF RADIATION IN LANGLEYS PER DAY RECEIVED ON A VERTICAL SURFACE FACING EAST DURING PERIOD OF RECORD.

Year	Month											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
	Langleys per day on East vertical surfaces											
1952									219	195	101	83
1953	90	128	147	198	240	339	261	249	231	148	120	108
1954	99	133	211	228	227	261	320	245	155	163	122	87
1955	114	144	192	146	272	259	288	218	198	115	107	108
1956	91	160	207	247	256	285	277	261				
Mean	99	141	189	205	249	286	286	243	201	155	112	96

TABLE 4—MONTHLY MEAN VALUES OF RADIATION IN LANGLEYS PER DAY RECEIVED ON A VERTICAL SURFACE FACING WEST DURING PERIOD OF RECORD.

Year	Month											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
	Langleys per day on West vertical surfaces											
1952									196	176	100	78
1953	85	151	144	213	232	327	294	233	224	155	104	96
1954	94	206	207	267	261	233	344	265	188	180	119	89
1955	124	145	205	203	324	253	335	325	348	159	113	117
1956	92	153	216	217	262	321	279	278				
Mean	99	164	193	225	270	308	313	275	239	167	109	95

of the other charts the radiation received on the West vertical surface was higher than that on the East vertical surface, with the exception of the months of October, November, and December. All traces showed peaks during June, but the West trace shows a tendency for flattening from May to July. The possibility of temperature and cosine response differences between the two pyrheliometers as contributions to these irregularities has not been evaluated. In Fig. 9 the average solar radiation values with cloud covers of 4 to 7-tenths indicate the expected depletion from the previous chart. The East and West traces nearly coincide after the middle of July, but prior to that time, with the exception of January, West vertical shows higher values. With 8 to 9-tenths of cloudiness (Fig. 10) the radiation values show further decline.

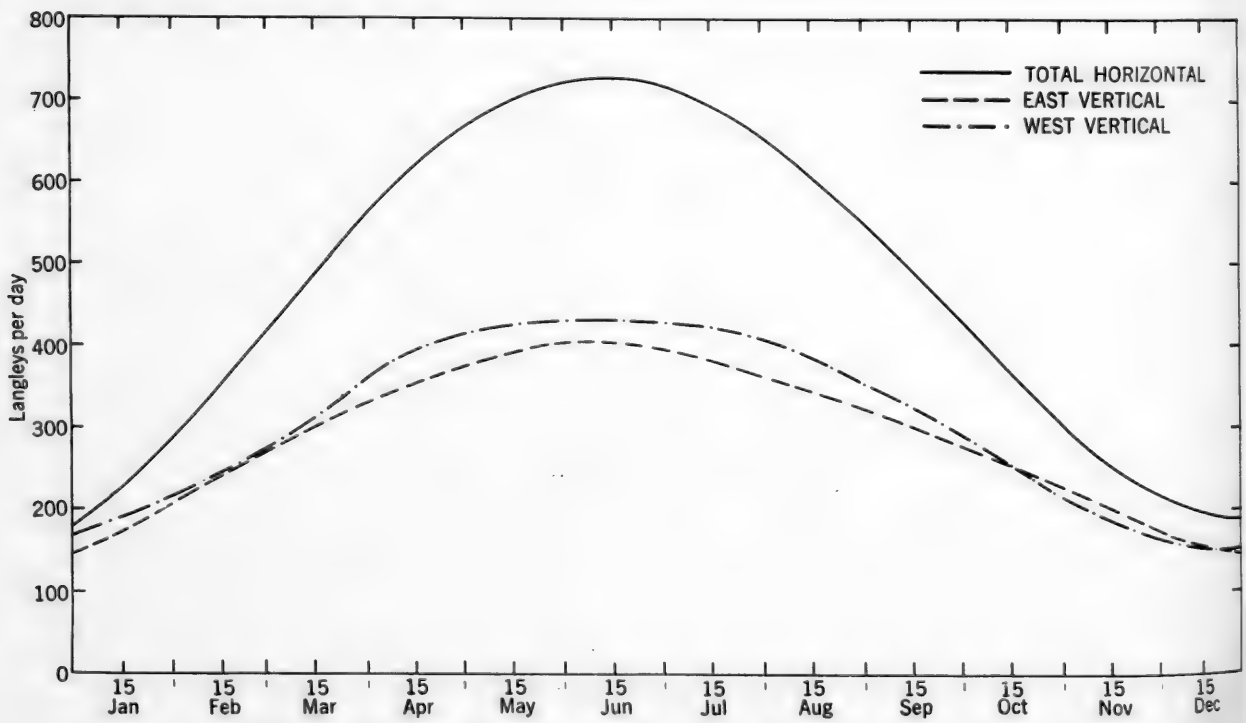


Fig. 8. Average daily values of solar radiation with sky cover of 0 to 3-tenths.

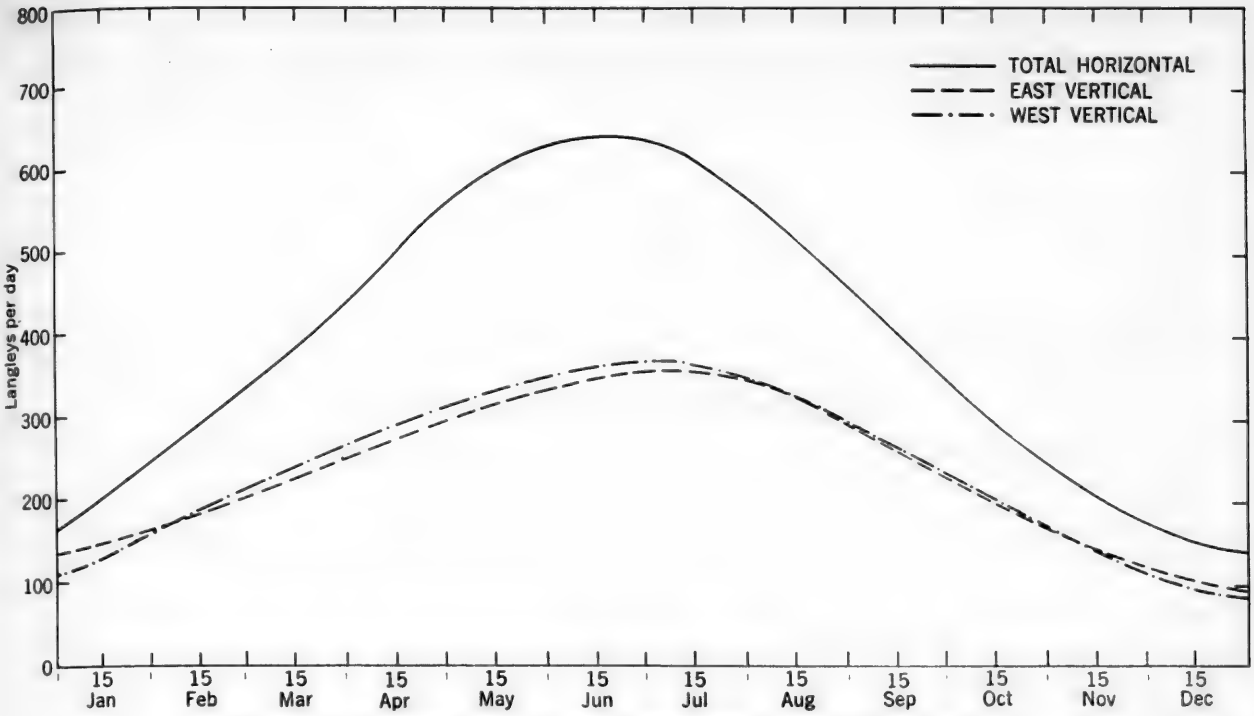


Fig. 9. Average daily values of solar radiation with sky cover of 4 to 7-tenths.

In attempting to draw radiation traces depicting values with overcast skies, we found a very wide scattering of values, and to resolve this, two charts were constructed. Figure 11 shows the traces drawn for overcast skies of low cloudiness, while Fig. 12 is the trace for middle cloudiness. There were not sufficient cases of overcast conditions of high cloudiness to accurately draw average curves for this condition. As is shown in Fig. 11, with overcast skies of low clouds, during the winter time (December, January, and February) daily values of the order of 25 langleys per day were most common on both the East and West surfaces, while during the summer 100 to 125 langleys were observed for the two respective surfaces.

A comparison of traces in Figs. 11 and 12 clearly shows the differences in attenuation of solar radiation

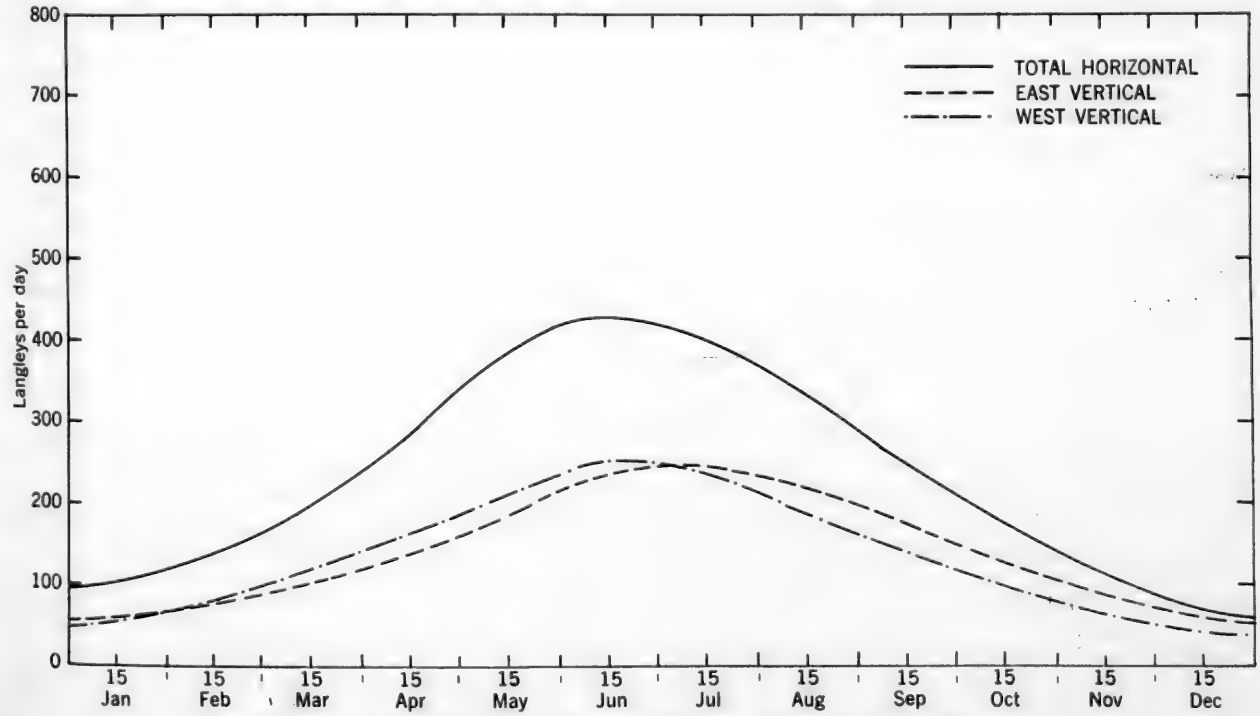


Fig 10. Average daily values of solar radiation with sky cover of 8 to 9-tenths.

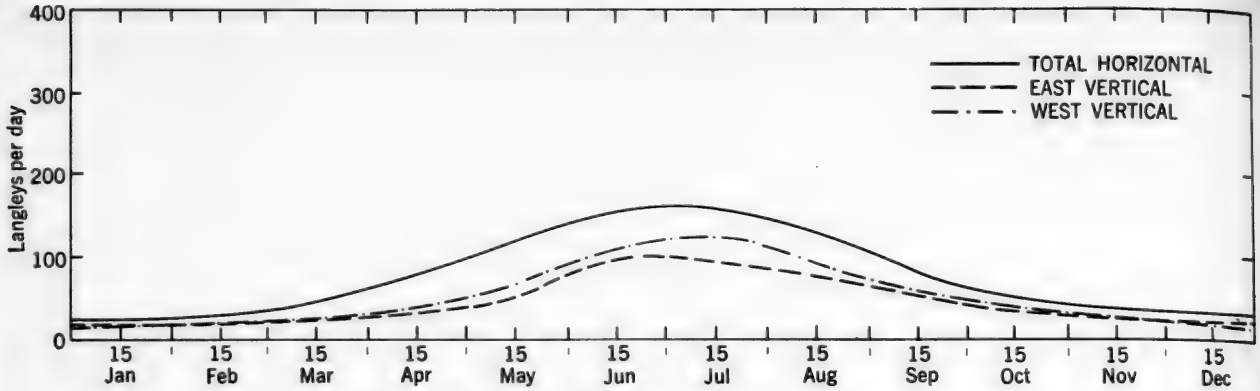


Fig. 11. Average daily values of solar radiation with overcast sky of low clouds.

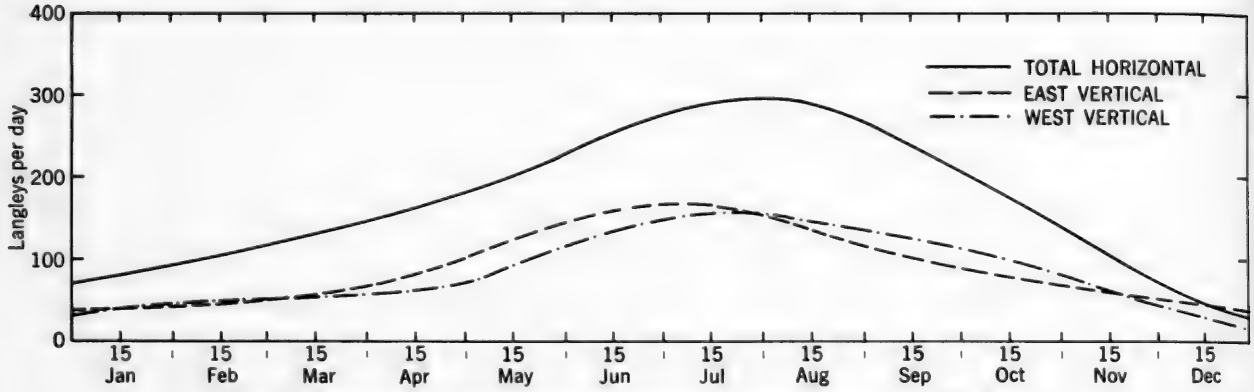


Fig. 12. Average daily value of solar radiation with overcast sky of middle clouds.

with different cloud groups. The middle clouds permit roughly between 10 and 30% more radiation to reach the ground than does the low cloud overcast.

Using the peak values of the zero to 3-tenths cloud cover traces as 100% indices values, Table 5 was constructed.

The ratio of the maximum values of the traces, for other conditions depicted, to each index were obtained to indicate the amount of depletion from different conditions. When clouds covered 4 to 7-tenths of the sky, the radiation received during the summer period dropped off 12 to 14%. With 8 to 9-tenths cover, a drop of 39 to 43% occurred, while an overcast of middle clouds produced a drop of from 59 to 63%, and low overcast clouds reduced the values 71 to 78%.

Since cloud conditions vary extensively, and since these traces cover values measured for a period of only four years, these cloud cover traces should not be used as absolute values to be expected for any particular condition.

TABLE 5—PERCENTAGE RADIATION RECEIVED ON THREE SURFACES FOR VARIOUS CLOUD CONDITIONS USING ZERO TO THREE-TENTHS SKY COVER VALUES AS BASE.

Surface	Fig. 8	Fig. 9	Fig. 10	Fig. 11	Fig. 12
Maxima (summer)					
East	100	88	61	41	24
West	100	86	57	37	29
Total horizontal	100	88	59	41	22
Minima (winter)					
East	100	93	37	27	13
West	100	70	27	21	9
Total horizontal	100	92	50	42	14

Standard Scales of Pyrheliometry

Towards the end of the 19th century, K. Angström, in Sweden, introduced the first reliable pyrheliometer intended for measurement of radiant energy emitted directly by the sun, reports the Newsletter of the Association for Applied Solar Energy in an article, *Fundamental Pyrheliometry*, by Drummond and Greer. The pyrheliometric scale embodied in the Angström device, which is still in wide use today, was adopted, in 1905, by the International Meterological Organization as the standard to which all solar radiation observations should be referred.

Quite early in the 20th century, the revised Smithsonian pyrheliometric scale of 1913 (defined from Abbot's measurements with his early series of blackbody water-flow radiometers) seemed to be more reliable and began to replace the European-originated scale.

In September, 1956, at the International Radiation Conference in Davos, Switzerland, a new scale, designated the International Pyrheliometric Scale 1956, was proposed and recommended for adoption. The advocated procedure is that (a) measurements of solar intensity made according to the original uncorrected Angström scale will be increased by 1.5%; and (b) measurements made according to the Smithsonian scale 1913 shall be decreased by 2.0%.

CARE OF LOW PRESSURE HEATING BOILERS DURING LAY-UP PERIODS

The proper care of large boilers for the space heating of commercial buildings can prevent unnecessary and very costly repairs. Those responsible for the proper maintenance and operation of all utilities within the structure can perform many parts of the job by utilizing their own personnel.

The custodian in charge of the heating plant should be expected to study his equipment, and to know how to properly care for and protect it.

Special and prompt attention should be given to a boiler in preparing it for the out-of-service period, whether it be two weeks or an entire summer.

The following steps, prepared by E. E. Finn, Consulting Engineer, Anthracite Information Bureau, New York, N. Y., are listed in sequence for securing a thorough job of preparation for the out-of-service period. These procedures will add many years to the life of any boiler, cast iron or steel, and will prevent serious interruptions during the heating season when repairs can be very costly.

Care of Water Side of Boiler for Lay-Up

1. Start work to be done on the boiler within 72 hr after the close of the heating season.

2. The fires should be drawn, and following the removal of all combustibles, the boiler should be drained while still warm.

Note: Valves to all radiators and all other heating elements should be opened wide to permit condensate to drain back to the boiler or boiler feed pump.

3. All manhole and handhole plates and washout plugs should be removed from the boiler. Apply oil and graphite coating to the gaskets.

4. Water side of the boiler's surface should be washed clean and free from all loose scale and sediment by flushing thoroughly with strong water pressure.

5. Use all washout openings, starting at the lowest point in the boiler and working toward the top; after this the boiler should be again flushed from the top down to the lower openings.

6. Open the city water or make-up water valve to flush the bottom of the boiler, afterwards make certain this valve is closed tightly and does not leak.

7. Flush out thoroughly all boiler accessories such as water column piping, water column, gage glass, pressure damper regulator, and steam gage. Contact points of all automatic controls should also be thoroughly cleaned.

8. For internal inspection of steam boilers after thorough cleaning, examine tubes, rivets, bolts, stays and fittings for corrosion, cracks, etc., and tap with hand hammer for ringing sound.

Fire Side Care for Lay-Up

1. Equally important is the care given to the proper preparation of the fire surfaces of the boiler. Fire tubes or flues should be punched or scraped thoroughly, using a scraper which cuts down to the tube wall, thus removing all soot, carbon, etc.

2. The entire grate assembly should be removed from the boiler and inspected unless a thorough check can be made while grate assembly remains in place.

3. Corners of the firebox as well as the inside firebox sheets, crown sheet, and front and rear tube sheets should be scraped free from all foreign matter, using a wire brush and scraper.

4. Outside firebox sheets, outer shell, and throat sheet on all bricked-in boilers should be thoroughly cleaned of soot and carbon. Also, the inner brick walls and boiler shelves should be cleared of all soot including the combustion chamber, smoke breeching and base of stack.

CARE OF LOW PRESSURE HEATING BOILERS DURING LAY-UP PERIODS

Fire Side Care for Lay-Up (continued)

5. Remove all soot from boiler room.

6. Inspect boiler thoroughly for any weakened or corroded places, and have the necessary repairs made as early as possible.

7. Coat all fire surfaces as far as possible with a mineral oil. In this procedure, special attention should be given to the fire tubes, the corners of the firebox at grate level, and the blow-off connection.

Wet or Dry?

There are two schools of thought for laying up boilers: Wet lay-up or dry lay-up. Either is satisfactory if properly done.

1. Dry Lay-Up. Allow boiler to remain dry and empty all summer, permitting free circulation of air through all parts of the boiler by allowing all doors and washout openings to remain open.

If boiler room is damp or air circulation is poor, moisture may be absorbed by placing pans of unslacked lime in the ash pit, replacing lime when necessary. Calcium chloride may also be used. Be certain to hang sign on boiler warning against burning waste material in fire box.

2. Wet Lay-Up. After the boiler has been cleaned, fill with water to the top. Keep all boiler doors closed to prevent condensation of moist summer air on the water cooled surfaces. Lower water to proper steaming level when starting fire in the fall.

Inspection of Boiler Setting

1. Check setting for cracks and air leaks, and check any brick work for deterioration.

2. Check supports and beams for soundness.

3. Check outside of shell for corrosion or small cracks.

4. Check parts subjected to heat for burning, blisters or bagging due to weak spots from scale or mud on the water side of boiler.

5. If there is a fuse plug, be certain it is clean and not covered with rust or mud so as to lose its effectiveness.

No effort should be spared in properly cleaning the boiler. A thorough cleaning is the only assurance of freedom from boiler trouble throughout the coming heating season.

General Recommendations

Breeching or smokepipe should be cleaned at least once a year. The bottom is more likely to rust out because of insulation from a layer of soot or fly ash, and the fact that it is a place for moisture to collect.

Where there is an unusually long breeching or one with elbows, it is advisable to install a gravity discharge hopper or tee under the breeching or smokepipe for continuous cleaning. A 10 to 12-inch pipe extending from the bottom of the hopper or tee to within 30 inches of the floor should contain two inexpensive slide gates which permit emptying without effecting draft adversely. This maintains uniform draft throughout the heating season and requires little cleaning of breeching for summer lay-up.

Check condition of boiler and piping insulation, and have necessary repairs made.

Operation of Centrifugal Pumps

IGOR J. KARASSIK and ROY CARTER
Harrison Division, Worthington Corp.

Part 2 of a two-part article that presents procedures for starting, operating and stopping a centrifugal pump and general rules on pump operation. Special operating problems are considered, and recommendations are offered.

AFTER a centrifugal pump has been properly installed, and all the necessary precautions have been taken in aligning it with its driver, the pump is ready to be put into service on its initial start. A few last minute checks are recommended. Cleanliness of the bearings and of the lubrication system is essential. Before putting the pump in service, the bearing covers should be removed, the bearings flushed with kerosene and thoroughly cleaned. Waste should not be used in cleaning bearings as lint can find its way into the lubricant and clean rags are superior for this purpose. Make sure that the oil or grease used in the lubrication system is free from water, grit or other contaminant. Fill the bearings with new lubricant in accordance with the manufacturer's recommendations.

Once more, with the coupling disconnected, test the driver for correct direction of rotation. There is generally an arrow on the pump casing to show the correct rotation.

A final inspection of all parts should be carefully made before starting. It must be possible to revolve the pump rotor by hand, and in the case of a pump handling hot liquids, the rotor must be free to rotate with the pump cold or heated. If the rotor is bound or even drags slightly, do not operate the pump until the cause of the trouble is ascertained and has been corrected.

Starting and Stopping Procedures

The steps necessary in the starting of a centrifugal pump will depend upon its type and the service on which it is installed. Many installations require steps which are unnecessary in other installations. For instance, in many cases, standby pumps are held ready for immediate starting. The suction and discharge gate valves are held open and reverse flow through the pump is prevented by the check valve in the discharge valve. This is particularly true of centrifugal boiler feed pumps.

When a pump is handling hot liquids, it is advisable to maintain an idle pump at approximately operating temperature. To this purpose, a constant small flow is permitted to take place through the pump. Many arrangements are available for this warm-up procedure. In some cases, flow takes place from the open suction through the pump and out through a warm-up valve on the pump side of the discharge valve. The drains from the warm-up valve are either returned to the pumping cycle at some lower pressure point than the pump suction, or go to waste if the liquid need not be reclaimed. In other cases, flow takes place through a jumper line around the discharge check valve, through the pump and into the common suction header. The exact arrangement to be used should be recommended by the pump manufacturer. Some pump designs are capable of starting up cold in the event of an emergency, but here again the pump manufacturer should be consulted for his opinion and recommendation.

The methods followed in starting are greatly influenced by the performance characteristics of the pump in

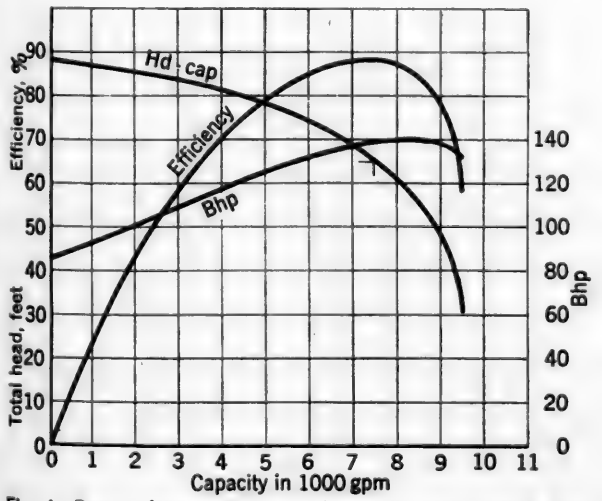


Fig. 1. Pump characteristics with power curve which rises with capacity increase, but is non-overloading.

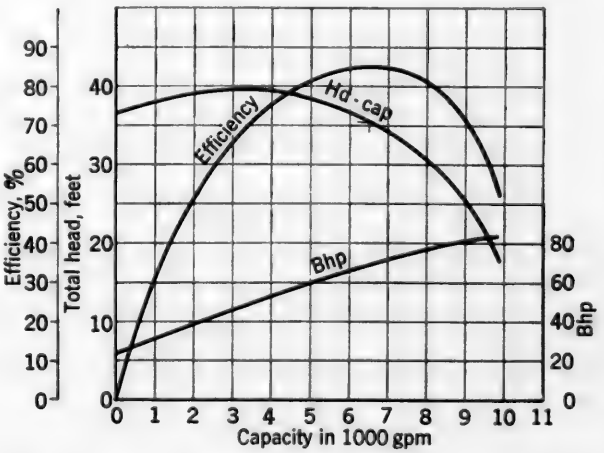


Fig. 2. Pump characteristics with overloading power curve, rising with capacity increase.

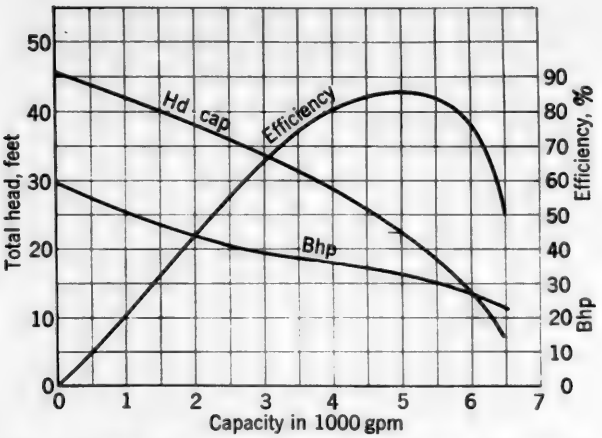


Fig. 3. Pump characteristics with power curve rising with a reduction in capacity.

question—that is by the shape of its power-capacity curve. In the case of high and medium head pumps (low and medium specific speeds), this curve rises from the shut-off condition to the normal operating capacity condition. See Fig. 1 and 2. For this reason, such pumps should be started against a closed discharge valve in order to reduce the starting load on the driver. The use of a check valve in the discharge line is equivalent to a closed valve for this purpose, as long as another pump is already on the line. The check valve will not lift until the pump being started has come up to a speed sufficient to generate a head high enough to lift the check valve from its seat. Of course precautionary measures against overheating the pump by operating it at shut-off may have to be employed, in certain cases, by installing a recirculation bypass. This subject was discussed in Part 1 of this article which appeared last month.

The power consumption curve of low head pumps (high specific speed), of the mixed flow and propeller type, has the opposite characteristic, rising sharply with a reduction in capacity, as shown on Fig. 3. Such pumps, therefore, should be started with the discharge valve wide open, against a check valve if required to prevent back flow.

Assuming that the pump in question is motor driven, that its shut-off horsepower does not exceed the safe motor horsepower and that it is to be started against a closed gate valve, the procedure would be as follows:

1. Prime the pump, opening the suction valve, closing the drains to prepare the pump for operation.
2. Open the valve in the cooling water supply to the bearings.
3. Open the valve in the cooling water supply if the stuffing boxes are water-cooled.
4. Open the valve in the sealing liquid supply if the pump is so fitted.
5. Open the warm-up valve of a pump handling hot liquids if the pump is not normally kept at operating temperature. When the pump is warmed up, close the valve.
6. Open the valve in the recirculating line if the pump should not be operated against dead shut-off.
7. Start the motor.
8. Open the discharge valve slowly.
9. Observe the leakage from the stuffing boxes and adjust the sealing liquid valve for proper flow to insure the lubrication of the packing. If the packing is new, do not tighten up on the bland immediately, but let the packing run in before reducing the leakage through the stuffing boxes.
10. Check the general mechanical operation of the pump and motor.
11. Close the valve in the recirculating line once there is sufficient flow through the pump to prevent overheating.

If the unit is to be started against a closed check valve with the discharge gate valve open, the steps would be the same except that the discharge gate valve would be opened some time before the motor is started.

In certain cases, the cooling water to the bearings and the sealing water to the seal cages is provided by the pump itself. This, of course, eliminates the need for the several steps listed in the starting procedure with reference to the cooling and sealing supply.

Just as in starting a pump, the stopping procedure depends upon the type and service of the pump. Generally, the steps followed to stop a pump which can operate against a closed gate valve would be:

1. Open the valve in the recirculating line.
2. Close the gate valve.
3. Stop the motor.
4. Open the warm-up valve if the pump is to be kept up to operating temperature.
5. Close the valve in the cooling water supply to the bearings and to water-cooled stuffing boxes.
6. If the sealing liquid supply is not required while the pump is idle, close the valve in this supply line.
7. Close the suction valve and open the drain valves as required by the particular installation or if the pump is to be opened up for inspection.

In case the pump is of a type which does not permit operation against a closed gate valve, steps 2 and 3 are reversed. Many installations are such that they permit the stopping of the motor before closing the discharge

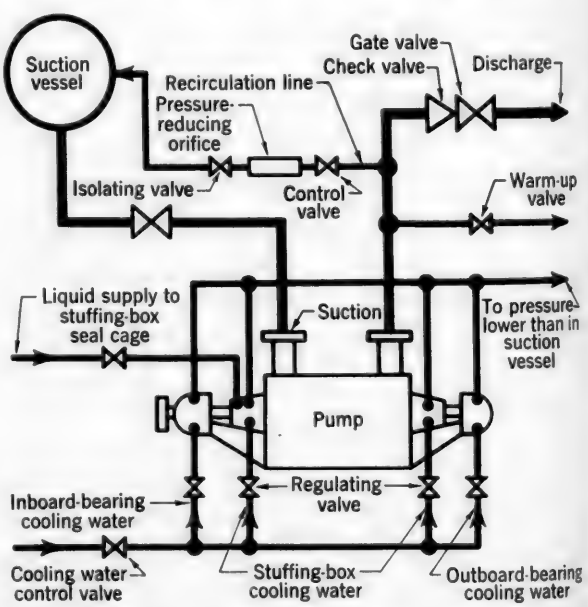


Fig. 4. Various connections and auxiliary services to a centrifugal pump. These have to be considered for start-up and stopping procedures.

gate valve. For connections and auxiliary services which must be considered for start-up and stopping, see Fig. 4.

In general, the starting and stopping of steam turbine driven pumps requires the same steps and the same sequence as necessary for a motor driven pump. As a rule, steam turbines have various drains and seals which must be opened and closed before and after operation. Likewise, most turbines require warming-up before starting. The operator should therefore conscientiously follow the steps outlined by the turbine manufacturer in starting and stopping the turbine. This holds equally well in the case of internal combustion drivers.

GENERAL RULES ON PUMP OPERATION

Running a Pump Dry

A centrifugal pump would have to have excessive clearances between the stationary and rotating parts before it could be run dry for an indefinite period of time. Most centrifugal pumps have close clearance leakage joints and cannot run dry at all—or in some cases for longer than a few seconds—without their being seriously damaged.

The one interesting exception to this rule concerns a certain design of automatic priming used with large, low head pumps. The pump is started dry at the same time as the vacuum pump is started and runs dry for a period not over two minutes, by which time the priming has been completed and the pump goes into normal operation. To insure successful operation under these conditions, the clearances at the wearing rings are made slightly larger than in the normal design.

Throttling at the Pump Suction

Throttling the suction of a centrifugal pump causes a reduction of the absolute pressure at the inlet to the impeller. This can be made to result in a reduction of capacity by forcing the pump to operate "in the break", and reducing the delivered capacity by altering the shape of the head-capacity curve. Such operation is harmful to the pump, unless, as in the case of a condensate pump, unit is specifically designed for it. One of the effects of operation "in the break" is reduction of pump efficiency, but most important of the ill-effects is the erosion and premature destruction caused by the cavitation induced by throttling the suction.

Since throttling the pump suction would be used to reduce the pump capacity, it is advisable to consider the relationship between the pump head-capacity curve and the system-head curve in order to appreciate why it is preferable to throttle the pump discharge. A centrifugal pump operating at constant speed will deliver a capacity corresponding to the intersection of its head-capacity curve and of the system-head curve of the system in which it is operating. The system-head curve itself is made up of the sum of the static and pressure heads and of the friction losses at various capacities. Figure 5 illustrates this relationship for a pump designed to deliver 1600 gpm against a total head of 160 ft. It has been assumed that the static and pressure head is 130 ft and that the friction losses at 1600 gpm are 30 ft.

If it is desired to reduce the delivery to 1300 gpm, it becomes necessary to alter either the head-capacity curve or the system-head curve, so as to cause their intersection at this reduced capacity. It will be seen from the curves shown on Fig. 5 that this can be accomplished either by throttling the suction or by throttling the discharge. In this latter case, artificial friction losses are introduced by throttling and a new system-head curve is obtained which now intersects the head-capacity at 1300 gpm and 176 ft total head. Since no advantage is given by throttling the suction and since the practice is harmful, throttling the discharge is the only recommended solution.

The only instance where throttling at the suction is permissible occurs when the suction pressure exceeds the minimum requirements by a very comfortable margin—such as in the case of the second pump of a series unit. However, here the effect is not to reduce capacity by operation in the break, but rather by the reduction of the total net head generated by the series unit. This causes the head-capacity characteristics and the system-head curve to intersect at a lower rate of flow.

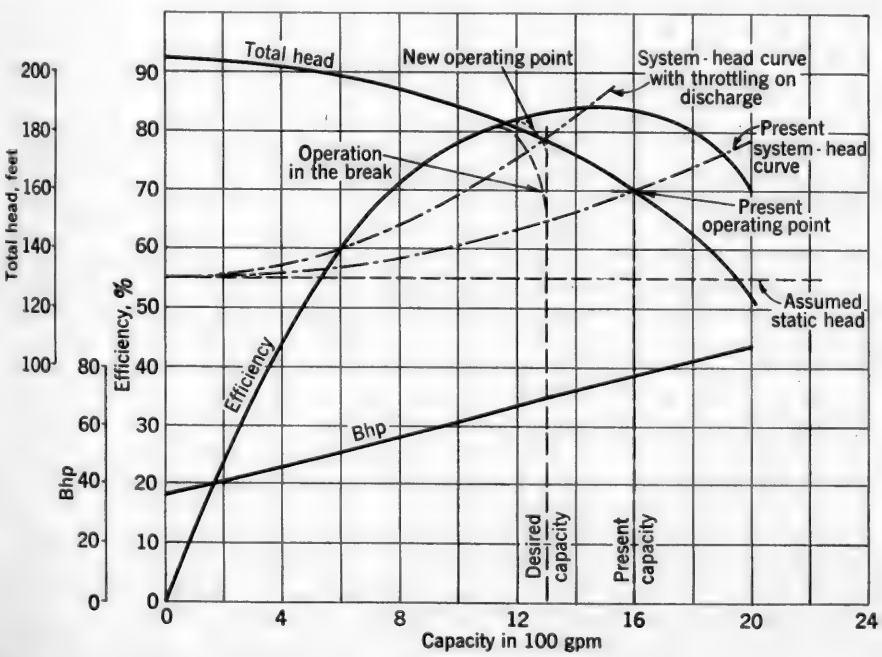


Fig. 5. Effect of throttling pump suction or discharge.

Restarting Motor Driven Pumps Stopped By Power Failure

Assuming that power failure will not cause the pump and its drivers to go into reverse rotation, or in other words that a check valve will protect the pump against reverse flow, there is usually no reason why the pump should not be permitted to restart once current has been reestablished. Whether the pump will start again automatically once power is restored will depend on the type of motor control used. Starters are made with low voltage protection, with low voltage release and without either. Those with low voltage protection will kick-out under low voltage conditions or following power failure and the units they control have to be restarted manually. Starters with low voltage protection can only be used with momentary contact pilot devices and cannot be used with maintained contact pilot devices such as float switches unless an auxiliary relay is incorporated in the control.

If the starter does not incorporate low voltage protection, resumption of power will always cause the unit to start again automatically. Because pumps operating on a suction lift may lose their prime during the period that power is off, it is preferable to provide starters with low load protection for such installations. This does not apply, of course, if the pumps are automatically primed or if some protection device is incorporated so that the pump cannot run unless it is primed.

Centrifugal and Reciprocating Pumps in Parallel

In general, operation of centrifugal and reciprocating pumps in parallel is not good practice. While in many cases a centrifugal pump could be operated in parallel with a reciprocating pump, the general performance of the centrifugal pump will be affected both mechanically and hydraulically by the pulsations of the reciprocating pump. A triplex pump would have the least effect on the operation of the centrifugal unit while actual troubles might be experienced if attempts were made to parallel a centrifugal pump with a single acting, single cylinder pump.

One more word of caution: It is important not to use a common suction line for a centrifugal and a reciprocating pump, especially if they operate under a high suction lift.

There are obviously a large number of problems encountered in the operation of centrifugal pumps which cannot be treated in a short group of articles such as this. Experience is a great teacher and if common sense is allied to the use of reasonable precautions, there is no reason why any of these problems should prove to be insurmountable. It is emphatically recommended, however, that the pump manufacturer be consulted if difficulties are encountered or if the choice between two different solutions of an operating problem seems doubtful or open to question.

Study Shows Attitudes toward Scientists

The public image of the scientist seems at best warped, according to a report in the *Industrial Bulletin* of Arthur D. Little, Inc., Cambridge, Mass. Despite current enthusiasm for increased scientific education, sociological studies show that in the popular mind the scientist and his work are often held in fairly low esteem.

One study completed by Drs. Margaret Mead and Rhoda Métraux sought to learn the attitudes of American teenagers toward science and scientists. The program was instigated by the American Association for the Advancement of Science and covered two separate samples —a nation-wide group of small high schools; and a group of high schools with widely different economic and educational characteristics.

All students agreed upon some aspects of the image of the scientist. He is a man [apparently never a woman] who wears a white coat and works in a laboratory; he is elderly or middle-aged, and wears glasses. He is surrounded by a jungle gym of blown glass tubes and weird machines with dials; he spends his days doing experiments, pouring chemicals from one test tube into another, peering raptly through a microscope, or injecting serum into animals—and he writes neatly in a black notebook.

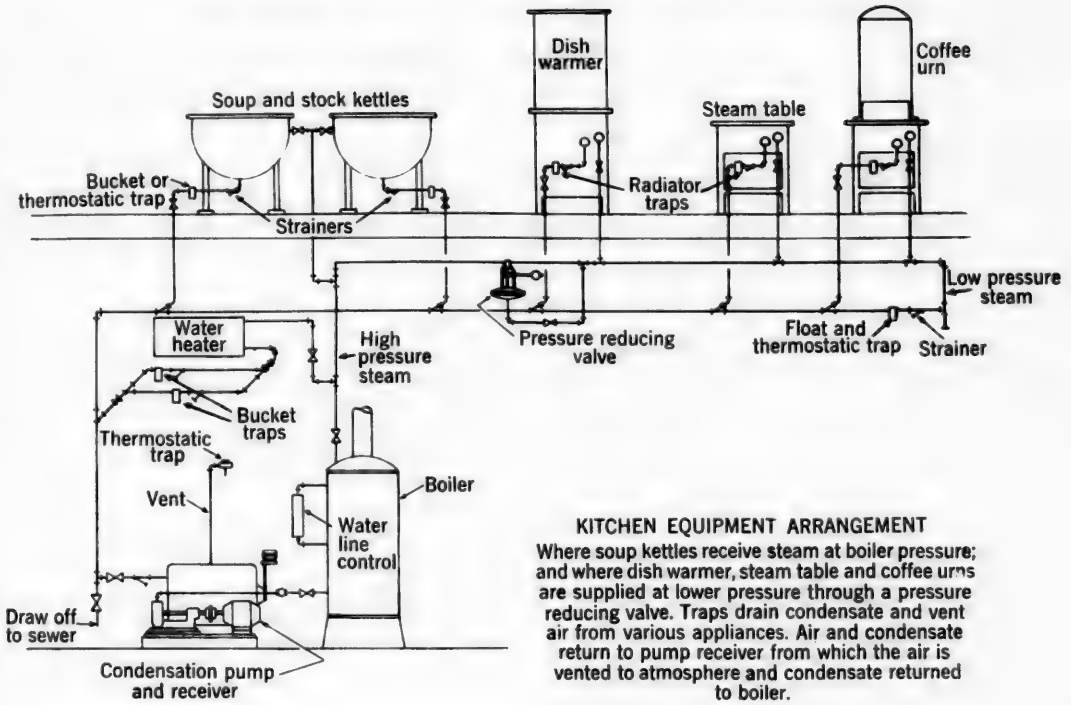
But then the views differ. On the positive side, the scientist is a genius, or almost a genius, who has had long years of expensive training. He takes his work seriously, is open-minded, and stands up for his ideas even when attacked. After long years of patient work in the laboratory, he may straighten up and shout [twice] "I've found it!" He is a dedicated man who works for the benefit of mankind; through his work, people will be healthier and live longer, our country will be protected from enemies abroad and travel to outer space will soon be possible. The future is on the scientist's shoulders.

On the negative side, however, the scientist is a "brain" whose work is dull, monotonous and time-consuming, and neither recognized nor recompensed. The lone scientist has heavy expenses, so he may live in a cold-water flat; the group scientist must do what he is told, and his discoveries must be turned over to the company and may not be used. His work may be dangerous; he has no other interests and neglects his body for his mind; he may not believe in God; his belief that man is descended from the animals is disgusting. Finally, he neglects his family and bores all others, either by always reading a book or with incomprehensible talk.

Drs. Mead and Métraux offer possible antidotes to these disturbing attitudes, in the form of concrete suggestions for representing science more fairly in the educational process and the mass media. And, assuming that high school students largely reflect the attitudes of their parents, may not their impressions come mostly from outside the school? Neglecting Hollywood as an all-too-frequently invoked whipping post, other sources of misinformation have been identified recently, and one is to be found in the field of science fiction where, interestingly enough, scientists themselves comprise a high proportion of the authors.

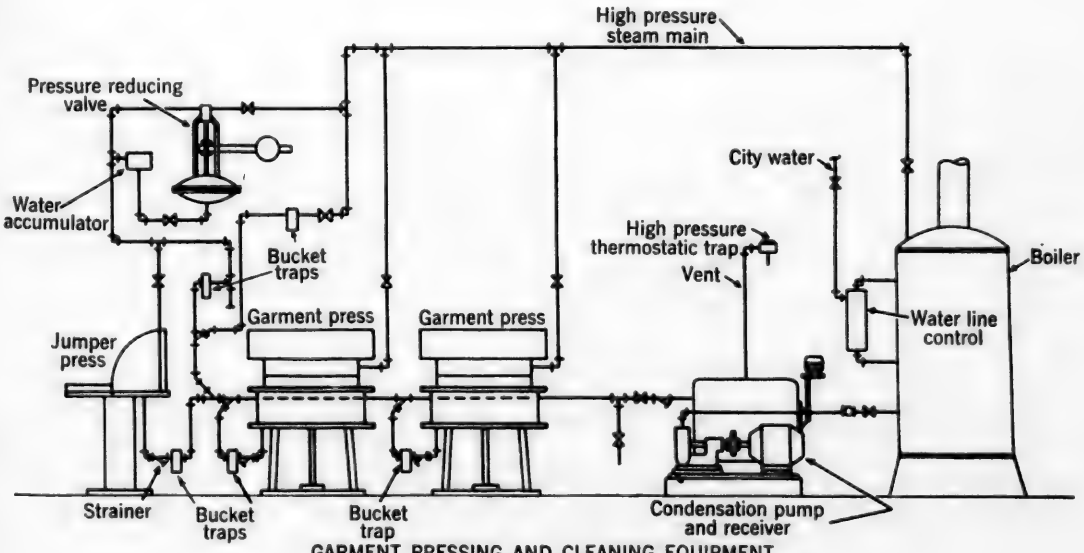
The opinions reported by the students certainly show little positive motivation toward science as a career. Many public figures, in the post-Sputnik era, are urging increased scholarship aid as a stimulus, even if temporary. Yet if there are deep-seated opinions and prejudices to be overcome, sales promotion for the natural sciences may prove to be a major job for the social scientist instead.

PIPING FOR TRAP APPLICATIONS



KITCHEN EQUIPMENT ARRANGEMENT

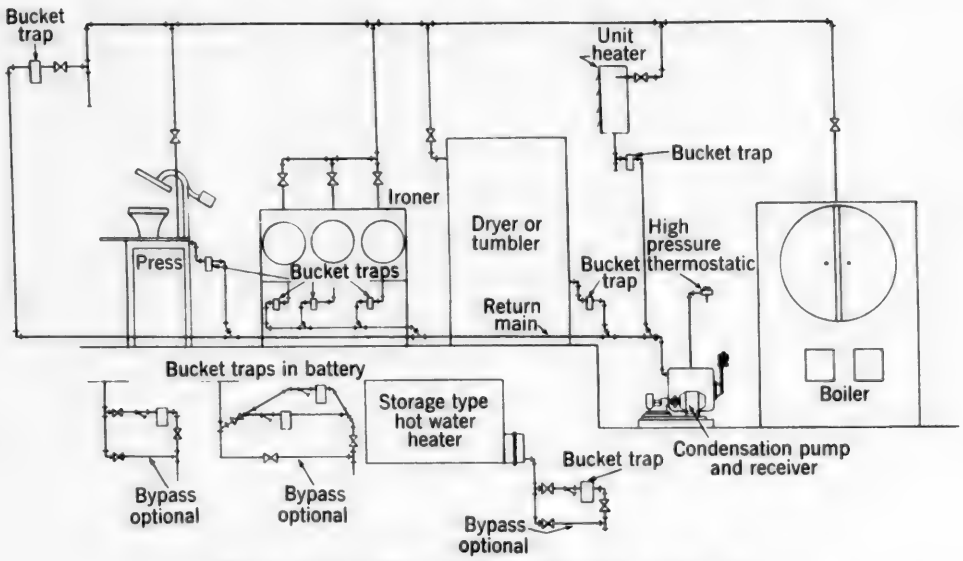
Where soup kettles receive steam at boiler pressure; and where dish warmer, steam table and coffee urns are supplied at lower pressure through a pressure reducing valve. Traps drain condensate and vent air from various appliances. Air and condensate return to pump receiver from which the air is vented to atmosphere and condensate returned to boiler.



GARMENT PRESSING AND CLEANING EQUIPMENT

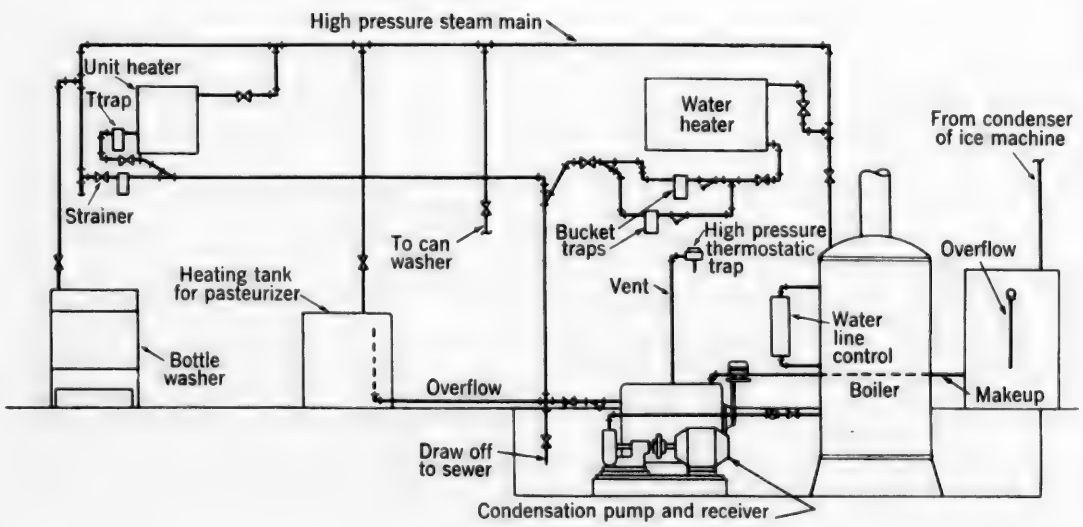
Operates most satisfactorily when steam is supplied at the proper pressure, individual appliances are properly trapped, and condensate is positively returned to the boiler.

PIPING FOR TRAP APPLICATIONS



TYPICAL INSTALLATION OF HIGH PRESSURE STEAM TRAP

Most satisfactory results are obtained by using a trap to drain each machine, and each roll of an ironer. This will avoid short circuiting which prevents complete venting and draining of individual units. Where steam pressure is not maintained on the unit (continuously), a check valve between the unit and the trap is recommended. This prevents water being drawn back into unit when steam is turned off. Each unit of equipment must be provided with sufficient trap capacity. If necessary, install traps in battery as shown.



TRAPS FOR DAIRY EQUIPMENT

Waste can be minimized by trapping and returning condensate to boilers.

Drawings on This and Reverse Side Courtesy of Dunham-Bush, Inc. From Dunham Product Application Manual

LUBRICATING OILS

Selection and Use of Oils for Refrigeration Units

EDGAR S. ROSS
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Proper lubrication is important for the efficient mechanical operation of refrigeration compressors and also for a full refrigeration cycle. Information is presented on the various qualities that are essential for a good lubricating oil for such service, and the various lubrication systems used with refrigeration and air conditioning equipment.

MODERN air conditioning and refrigeration equipment and systems, though they exhibit a wide variation in design, have one important characteristic in common—they require a highly specialized type of lubricating oil.

The development of modern refrigeration oils parallels the following important developments in the design of modern refrigeration equipment:

1. The introduction of hermetically sealed units that require oils capable of giving lifetime lubrication.

2. The increased use of the Freon family of refrigerants. Since these refrigerants mix in varying degree oils had to be developed to give adequate lubrication even under these conditions.

3. Lower temperature demands, which make it necessary to use oils with extremely low wax separation points.

4. Since some lubricating oil, although useful only in the compressor may travel through the entire system with the refrigerant, it must not only be compatible with the refrigerant but it must not react with any of the metals or nonmetals encountered. Besides, it should withstand extremes of temperature and pressure.

Until the coming of domestic refrigeration, "ice machine oils," as they were usually called, were given very little special consideration. The older types of ammonia and carbon dioxide machines could be lubricated efficiently with ordinarily good lubricating oils and were no more of a problem than pumps or gasoline engines. The household unit, however, introduced something new.

Two conditions that developed with the use of hermetically sealed units for household refrigeration made the durability of lubricating oil much more significant and called for oils having properties not previously required:

1. It demanded long service without any maintenance attention.

2. It led to the wide use of a number of refrigerants that had previously been of little practical importance.

Essential Characteristics of Refrigeration Oils

These new demands, supplementing former quality requirements for lubricating oils, may be summed up in the following list of essential and desirable characteristics that must be given full consideration in the selection of proper compressor lubricating oil.

Basic Qualities for Industrial Lubrication. The four qualities an oil must have for general industrial lubrication are:

1. Proper viscosity, so as to maintain a good body at highest operating temperatures, to remain fluid under coldest operating conditions, and to provide a protective film at all times.
2. Oxidation stability, the ability to resist deterioration and provide long economical life in an oil. This requirement naturally varies with the intended use of the oil.
3. Freedom from carbon-forming tendencies, particularly where an oil is to be used in engines or compressors.
4. Freedom from corrosive tendencies, combined with positive protection of machine parts to improve their corrosion resistance.

Refrigeration Service Requirements. In refrigeration and air conditioning equipment, only those oils that rank highest in these four qualities should be considered for lubrication. However, in addition, there are six more properties or characteristics that are necessary. These extra six features put refrigeration oils in a class by themselves:

1. Greatest possible extra stability for trouble-free service life with minimum maintenance.
2. Extremely low pour point. Refrigeration oils in conjunction with refrigerant, must flow at temperatures as low as —100 deg F, or even lower, depending on the application.
3. Lowest possible floc point, or temperature at which wax particles separate out from the oil and congeal. Refrigeration oils must be exceptionally free of wax and other solids, whatever wax remains (depending on the nature of the refining process) must not separate out until temperatures as low as —120 deg are reached.
4. Freedom from moisture. Frozen moisture can clog capillaries, valves, and evaporator tubes. Moisture in the high side can set up chemical reactions with some refrigerants, leading to corrosion, copper plating, and damage to refrigerant lines.
5. Chemical inertness to refrigerants, so that no combination of oil and refrigerants can create harmful impurities.
6. Ability to separate rapidly from refrigerant when the oil returns from the low side of the compressor.

Another quality, economy, might well be added. The oil should possess all of the characteristics mentioned for use on an entirely practical and economic basis in terms of availability, cost, and service life.

REFINING OF LUBRICATING OIL DISTILLATES

The general objective of lubricating oil refining is the improvement of oil properties so as to render the oil most suitable for specific service demands. Oil properties can be improved in a variety of ways, which may be summarized as:

1. Removal of undesirable constituents from the crude products.

2. Conversion of undesirable constituents into desirable ones by changing their chemical structure through hydrogenation, condensation, and other processes.

The removal of deleterious substances is the more important of these approaches at present. To varying degrees, the undesirable substances include wax, asphaltic and resinous materials, and oxygen, sulfur, and nitrogen compounds. What percentage of these are removed depends upon the ultimate use for the oil. The use of additives, which are chemical compounds designed to prevent deterioration of the oil or to give it properties which it cannot exhibit naturally, is today as important as the removal of unwanted constituents.

Edgar S. Ross, engineering consultant, Industrial Products Development, Sun Oil Co., Philadelphia, Pa., received a B. Sc. Ch. E. degree in 1917 from the University of New Hampshire and his M.S. from the same university in 1921. From 1924 to 1926 he attended the graduate school of the University of Pittsburgh. He was senior research fellow, Mellon Institute of Industrial Research from 1923 to 1928. He came with Sun Oil Co., development division, in 1933, and with exception of a period of leave from 1943 to 1944, he has been with that company ever since. He was on leave then to serve as chief, Lubrication Section, Petroleum Administration for War. From 1944 to date he has served as engineering consultant, Industrial Products Department. He is the author of many technical papers on the derivation, manufacture and use of mineral lubricating oils. Mr. Ross is a member of A.I.Che. E., A.C.S., A.S.T.M., International S.T.M., Refrigeration Institute (Paris), A.S.R.E. A. S. Lub. E., Franklin Institute, Alpha Chi Sigma (hon. chem.) He is a professional engineer, registered in Pennsylvania.

Sulfuric Acid and Solvent Refining

With few exceptions, all petroleum products must be treated in some manner, for any or all of the following reasons:

1. Improvement of color and odor.
2. Removal of sulfur compounds.
3. Removal of resinous or asphaltic substances.
4. Removal of organic acidic compounds.
5. Improvement of stability on exposure to air and light.
6. Altering physical or chemical properties of the oil.

The two main classes of treatment are sulfuric acid refining and solvent refining. Clay treatment might also be classified as a third method, although it is often used in conjunction with the other two.

Sulfuric acid involves both chemical and physical action; solvent treating is a physical process; clay treating is a combination of both. The choice of methods depends on many factors such as source of crude, desired characteristics of final products, and economics. A simple example is the fact that the viscosity index can be raised, when desired, more effectively by solvent refining than by acid treatment.

Over-refined Oils

It is quite possible to over-refine a refrigeration oil. When first charged into a system, highly refined oils, known as "white oils," have excellent initial resistance to the formation of oxidized sludges. But the performance of these oils is unpredictable. This early resistance is followed by an extremely rapid rate of general deterioration in service, resulting in very much shortened service life unless highly inhibited. Instead of forming insoluble types of sludges, the deterioration of a white oil goes in the direction of resin and acid formation, causing increase in corrosiveness.

So-called "pale oils," which are moderately refined, have less resistance to sludge formation at first, but de-

velop greater overall resistance to deterioration in the long run. Resin and acid formation in pale oils is relatively much lower than for white oils, and the acids so formed are distinctly less corrosive. As a result of refrigeration-industry experience, only a very small percentage of all refrigeration oils in use today are white oils.

Two Type Oils Compared

There are two basic classifications of crudes—paraffinic and naphthenic, with many gradations in between. Years of practical service experience have shown that certain naphthenic oils possess many outstanding qualifications for refrigeration compressor lubrication service and are accordingly recommended over paraffinic or mixed-base oils, for the following reasons:

A lubricant made from a paraffinic crude tends to form sticky carbon deposits under high temperatures and pressures. These deposits can harden on compressor valves and discharge passages, decreasing volumetric efficiency. With naphthenic-base oils, on the other hand, the soft, sooty nature of the small amount of carbon that does form, prevents it from accumulating and clogging the system—coking out in the valve areas.

In addition, naphthenic-base oils have much lower pour points than paraffinic, as well as much lower floc points when used with miscible refrigerants, making them especially superior for low temperature operations.

Uninhibited Oils vs. Inhibited Oils

The last several years have seen a very considerable interest and increase in the use of additives. The selection of an oxidation inhibitor, for example, requires careful consideration on the part of the refiner of such factors as type of oil, method by which it has been refined, and expected service conditions. Such considerations can result in the selection of different inhibitors for use in the same base oil when the service conditions are sufficiently different.

Inhibitors can control corrosion, sludging, acid formation, and viscosity increase. While any one oxidation inhibitor may have a beneficial effect in the majority of applications, the optimum results for any particular service can be obtained only by careful selection of available additives.

Inhibitors have variable effects, such as slowing down the rate of deterioration to a very low level, or apparently stopping all deterioration, for all practical purposes, for a very considerable period of time.

While inhibitors occasionally do have somewhat different effects on the various byproducts of deterioration, they more often affect these byproducts to a common degree. Future developments may well see the use of inhibited oils especially in the large or commercial and industrial type units.

Narrow Cuts vs. Wide Cuts

The means a refiner uses to produce an oil of a certain viscosity is almost as important as the viscosity itself. If an oil is blended of stocks of different viscosities to arrive at an average-viscosity oil, there will be light ends that carry over into the expansion coils and build up on evaporator tubes. This will leave behind abnormally heavy oil portions in the compressor.

On the other hand, an oil of too "narrow" a cut—i.e., too homogeneous—may lack the ability to adapt to extreme temperature changes. These terms apply to the boiling-point range in lubricating oils.

Today the refiner follows the path of moderation. In other words, the two extremes are avoided; a too-narrow cut is impractical, and a too-wide cut is undesirable because of the presence of extremely light and extremely heavy ends. Between these extremes are the properly refined straight refrigeration oils, made especially for the temperature ranges encountered in refrigeration and air conditioning compressors and other equipment, as well as for the other properties or qualities to be discussed.

SIGNIFICANCE OF OIL PROPERTIES IN REFRIGERATION APPLICATIONS

Lubricating oils have been evaluated according to various physical and chemical tests, but unfortunately too great a reliance has been placed, in the past, on many of these tests in predicting the ability of a lubricant to perform well in service. More recently, performance-type tests have been developed for various applications, which are much more instructive in estimating the suitability of a lubricant.

Gravity

As a specification item, the specific gravity of an oil is of questionable worth, and carelessly written specifications on gravity may eliminate some highly suitable oils. For a given oil, the gravity, expressed in degrees A.P.I. (American Petroleum Institute), is an index of the boiling point. Paraffin-base crudes have lower specific gravities (higher A.P.I. gravities) than the naphthene-base crudes; for oils of equivalent viscosity for a specific service, naphthene-base oils may run 5 to 10 units in A.P.I. gravity lower than paraffin-base oils, with mixed-base oils in between. Refining an oil increases the A.P.I. gravity whether the refining agent is acid, solvent, or clay.

Viscosity

The viscosity, or coefficient of internal friction, is that property of liquid substances that is responsible for resistance to flow.

For lubricating oils, viscosity is extremely important since it determines the bearing friction, heat generation, and rate of flow under given conditions of load, speed, and bearing design. The oil should be viscous enough to maintain a fluid film between the bearing surfaces in spite of the pressure tending to squeeze it out, yet not too heavy to cause drag, loss of power, and increased operating cost.

For refrigeration use, too heavy an oil will not drain sufficiently from evaporator coils when carried over by the refrigerant. Naphthenic-base oils tend to offer additional protection by virtue of their property of increasing viscosity with increased bearing pressure.

As will be described later in more detail, when the lubricating oil and refrigerant are mixed, the viscosity of the oil must be high enough to give satisfactory lubrication when thus diluted by the refrigerant.

Viscosity index is an empirical expression denoting rate of change of viscosity with change of temperature. An oil rated at 100 V.I. has the least rapid change of viscosity with temperature, whereas an oil rated zero V.I. has the most rapid change of viscosity with temperature.

Pour Point and Cloud Point

All oils will congeal or cease to flow if cooled to a sufficiently low temperature. The temperature at which flow ceases under the conditions of test is known as the pour point.

As an oil is cooled under the prescribed conditions of test, it may show a cloudy or hazy appearance due to the presence of wax or moisture. The temperature at which this occurs is known as the cloud point. Cooling of a 10% oil-in-Refrigerant 12 solution may be continued until wax, if present, will separate in flaky or flocculent form, this temperature being designated as the floc point.

Cessation of flow at the pour point may be due to wax solidification in paraffinic-base oils, or to the fact that the viscosity increase due to cooling of a naphthenic-base oil no longer permits ready flow. Naphthenic-base oils exhibit pour points normally much lower than those of paraffinic-base oils of comparable viscosities.

Carbon Residue

Tendency for an oil to form carbon deposits is of considerable importance in their selection and use. The nature of the carbon as well as the amount is significant. In an automobile engine, a light fluffy carbon is more desirable than a hard adhesive form, since the former will be removed with the exhaust gases. As noted, the paraffin-base oils form the hard carbon, and naphthene-base oils form the soft carbon residues.

Refrigerator compressor oils must be sufficiently well refined from selected crudes to avoid deposits of hard, adhesive carbon when exposed to hot spots in a refrigerator cycle.

Oxidation Stability

Useful life of an oil depends in considerable degree on its resistance to oxidation. Oxidation is actually a complex series of processes that lower an oil's efficiency. Some of the more obvious symptoms of oxidation are: Increase of viscosity; acidity increase; darkening of color; increase of sludge, resin content, and carbon deposits.

Since today's equipment is designed for increasingly exacting conditions, oxidation is more and more difficult to avoid. Refrigeration oils must be constantly improved to meet these conditions. The refiner must start with distillates of known, high quality from selected crudes and improve the oils by consistantly better treatment, and in some cases, by use of inhibitors that are carefully selected to give optimum results.

Catalytic Effect of Metals. When an oil is exposed to oxidation conditions, the presence of certain metals may bring about an increased rate of deterioration. Copper is the worst offender, followed by lead and iron. Under certain conditions, tin and zinc may actually serve as retardants or inhibitors rather than catalysts. Copper alloys such as brass and bronze are also catalytic. Obviously these metals should be avoided so far as possible in the design of refrigeration and air conditioning equipment wherever they would come in regular contact with lubricating oils, or steps taken to nullify their catalytic effect by means of suitable additives.

Copper Solubility and Copper Plating. In refrigerating units using halogenated refrigerants and containing considerable amounts of copper (in coils, tubing, and electric motors), an electrolytic action may take place—in the presence of moisture — wherein metallic copper is deposited on cylinder walls, pistons, valves and bearings, thus causing faulty operation of the compressors. This action can be greatly magnified by the presence of excessive "stray electric currents" in the system.

Lubricating oils and refrigerants were formerly blamed as the source of this trouble, and some authorities advocated the use of white oils to stop this copper plating. Results of careful and thorough investigation, however, have proved that merely using white oils in such cases will not prevent the condition since the absence of moisture is the most corrective step. Such use may tend to promote it by developing corrosive acids. Copper plating can be initiated and sustained only when excessive moisture is present in the system. Some investigators still claim that copper plating can occur in a dry system but some question still remains as to the existence of a dry system in actual practice.

Moisture Content. As ordinarily prepared, packaged, and shipped, refrigeration oils have a sufficiently low free moisture content to give dielectric strength (insulation resistance to flow of electricity) of over 25,000 volts. With the present care exercised in completely dehydrating all systems initially, as well as introducing dehydrating cartridges, troubles due to moisture, including copper plating, have largely disappeared. However, there is always the possibility of getting the wrong lubricating oil for the refrigeration job, so that oxidation, moisture content, and copper plating do become problems.

Wax Content in Oils

While carbon deposits can plague the system, due to excessively high temperature, wax and other solids, such as insoluble resins, can cause further difficulties in the low side due to extremely low temperatures.

Refrigeration oil must not only be essentially wax-free to prevent interference with circulation of the refrigerant, as mentioned at the beginning of the article, but it must also be free of all other solids that cause troublesome deposits. In the matter of wax formation, new refrigerants that unwittingly act as solvent dewaxing agents on the oil and cause greater separation of wax on the low-temperature side of the system. Unless the oil has been specially refined from a low-wax crude, and has an extremely low floc point, the wax and other solids are carried along in the liquid stream (oil-refrigerant mixture) through the expansion valve and right-angle flow-line, building up a heavy layer of wax on the side walls. Periodically the wax breaks off in large chunks and passes on into the capillary tubes, clogging them more or less permanently, depending on the type of wax or solids.

As new developments in equipment and application call for lower and lower evaporator temperatures, wax and other solids in refrigeration oil become more and more critical. The refiner must, therefore, constantly tighten his requirements of low-wax crudes and improve his extraction processes.

Wax in oils is ordinarily determined by the methyl-ethyl-ketone (MEK) test, the amount of wax separated out at —10 deg being specified. The already well-established grades of oil are demonstrating their reliability in this respect. They show minimum increase in wax separation as temperature is lowered, and their subsequent behavior can thus be predetermined with some degree of

certainty. Obviously the sole criterion is that the oil will not wax out under any working conditions.

The Floc Test

The most important, and most revealing, method of determining the waxing tendency of a refrigeration oil is the floc test. A mixture of 10% oil by weight in 90% Refrigerant-12 is gradually cooled until the bright mixture becomes cloudy and a flocculent precipitate appears. This temperature is call the floc or waxing point.

The best refrigeration oils remain clear down to —50 or —80 deg depending on viscosity grade. In this test the oil is motionless. The percentage of oil in the refrigerant, 10%, is much higher than the proportion usually found in the low side. For all practical purposes, oils with floc points of from —50 to —80 deg are safe to use at temperatures down to —120 deg, depending on the viscosity required.

When subjected to the floc test, high-wax-content oils form waxy precipitates at relatively high temperatures. As the temperature is gradually lowered, the wax first appears as a light, flaky precipitate. As the temperature is still lowered to —35 deg, the precipitate becomes thicker until the whole tube appears to be filled with a white flocculent wax. A rough comparison of the wax content of two or more oils can be made by subjecting all samples to the floc test at the same temperature, then observing the degree of precipitation.

EFFECTS OF REFRIGERANTS ON OILS

Years ago, when commercially-used refrigerants had little or no solubility effect on the oils used, it was not necessary to be concerned with such things as viscosity dilution, wax content, floc point, and the like. However, with the now prevalent use of halogenated refrigerants, such as methyl chloride, methylene chloride, and the Freon-type group, it is pertinent to know more about the oil-refrigerant relationships, such as miscibility, solubility in both liquid and vapor phases and stability, and the effect or function of temperature and pressure on these relationships.

Each type and/or grade of refrigerant has its particular effect on refrigeration oil. The user should know these effects or obtain advice from specialists. Wrong choice of lubricant can result in inefficiency or failure of equipment.

Anhydrous Ammonia (NH_3)

Anhydrous ammonia does not mix appreciably with oil, nor react with it, but it can react with certain types of additives and create difficulties. It does not affect the viscosity of the oil. But if moisture has been carried into the system by the oil or the refrigerant, ammonia will freeze in the expansion coils or emulsify with the oil at the compressure temperature, causing shutdowns in either case.

Carbon Dioxide (CO_2)

Carbon dioxide has no effect on oil, since oil is not soluble in this refrigerant. Good lubricating oils have a sufficiently high flash point to prevent the formation of vapors which might be carried along with the refrigerant.

Sulfur Dioxide (SO_2)

Sulfur dioxide must be perfectly dry before it is introduced into the system, because this refrigerant is very soluble in water, forming a strongly acidic and highly corrosive solution. The lubricating oil, therefore, must be equally free from moisture (dehydrated).

Sulfur dioxide is only slightly soluble in oil at ordinary temperatures, and does not appreciably reduce the oil's viscosity. But since SO_2 is a selective solvent, only highly refined oils should be used for the lubrication of units using this refrigerant; otherwise the oil will be attacked and a gummy sludge will settle out to clog capillaries and valves.

Methylene Chloride (Carrene-1)

Methylene chloride is a halogenated hydrocarbon refrigerant frequently used for systems equipped with centrifugal or rotary type compressors. The reaction and miscibility of this refrigerant with lubricating oil are very similar to those of the Freon group.

Methyl Chloride (CH_3Cl)

Methyl chloride, another halogenated refrigerant, is a gas that dissolves in oil in somewhat limited proportions at temperatures and pressures encountered in refrigerating systems. It does not react chemically with well refined lubricating oils, but is extremely unstable in the presence of excessive moisture.

The Freon Group and/or Their Equivalents

Like the other halogenated refrigerants, those of the Freon group do not normally react chemically with high-grade well refined lubricating or refrigeration oils. These refrigerants mix more or less freely with oil (see later discussion of Refrigerant-12 and Refrigerant-22) so that the lubricant is actually an oil-refrigerant mixture of much lower viscosity than that of the oil alone. As a result, higher-viscosity oils are usually specified for use with these refrigerants to allow for this thinning out. The user can allow for this decrease in viscosity because it can be measured, as indicated by the two graphs, Fig. 1 and 2, which pertain to Refrigerant-12.

Viscosity-Temperature Balance. Figure 1 illustrates the balance between viscosity and temperature for Refrigerant-12 mixed with one type of refrigeration oil. Each diagonal line on the temperature-viscosity chart represents a percentage by weight of oil in the refrigerant.

As temperature increases, viscosity decreases. Also, as the percentage of refrigerant in the oil is increased, viscosity of the oil-refrigerant mixture drops to a lower diagonal line across the chart.

Changes of pressure encountered by the oil in the refrigerating cycle affect the amount of refrigerant that can be mixed with the oil. This is fortunate, for it provides a means of separating, to a certain extent, the two fluids at the compressor, where such separation is most needed.

Solubility. Figure 2 is a solubility chart showing per cent by weight of Refrigerant-12 mixed with one type of refrigeration oil versus gage pressure, psi, indicating how much refrigerant will mix with how much oil at the various operating temperatures. By balancing the percentage of oil that will mix with the refrigerant in a given set of compressor conditions against the viscosity of that oil-refrigerant mixture at compressor operating

temperature, it is possible to determine the approximate amount and viscosity of oil present in the compressor to provide the required lubrication.

How to Use the Charts. As an example, assume that you have a compressor operating at 160 deg. and 140 psig in a Refrigerant-12 system. The oil viscosity recommended by the manufacturer or established by experience is 150 SSU at 100 deg. How much oil will mix with the refrigerant under these conditions?

From the solubility chart, Fig. 2, you will find that the highest percentage of Refrigerant-12 the oil will hold is 27%. The capacity of the system to be lubricated will indicate the quantity of oil to be charged into the system to provide that percentage at the compressor temperature.

Another question may be: What is the viscosity at 160 deg of a refrigerant-oil mixture in the crankcase containing 27% Refrigerant-12? On the Temperature-Viscosity chart Fig. 1, which shows a 150 SSU oil, draw a line parallel to the other diagonal lines at the 27% position. This line will cross the 160-degree vertical line at 34.5. The viscosity of the mixture, then, is 34.5 SSU.

Refrigerant-12 vs. *Refrigerant-22.* A somewhat different set of rules applies to the use of Refrigerant-22. For example, above 53 deg, this refrigerant mixes completely with 300 SSU oil in all proportions, but when the mixture encounters temperatures lower than this, part of the oil leaves the solution and forms a layer over the saturated oil-refrigerant mixture in the receiver. The lower the temperature drops, the larger is the proportion of oil leaving the solution and joining the layer floating on top.

Figure 3 illustrates the oil-refrigerant relationship when using Refrigerant-22. Two lines are shown. The bottom curve shows Oil *B*, the top line Oil *A*. The top of each curve shows the temperature at which each oil mixes freely with Refrigerant-22 in all proportions. Working backward from this point, one can see the decrease in percentage of each oil that will mix with Refrigerant-22.

For example, on the *A* curve, at 53 deg, 19% of the oil will be accepted by the refrigerant. At 52 deg, not over 18% of the mixture will consist of oil, the remainder being refrigerant. But at 42 deg, only 11% of the mixture will be oil, and at—34 deg, the pour point of the oil, 1.4% of the mixture will be oil. Any oil present over and above these percentages at the temperatures cited will remain as free oil in the oil phase only of this two-phase system.

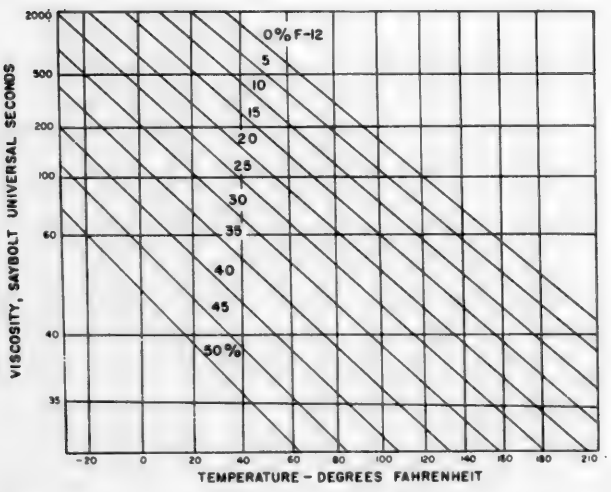

Fig. 1. Temperature-viscosity chart, Refrigerant 12 in Type B oil.

Returning to the high point of the *A* curve, we note that after the 19% point has been reached at 53 deg, the mixture changes from a saturation of oil in the refrigerant to a saturation of refrigerant in the oil. Instead of the refrigerant throwing out free oil in excess of the amount it can absorb as the temperature falls, oil throws out free refrigerant. Under the "dome" formed by either of these curves in a given refrigerator system, there is a heterogeneous zone containing a mixture of oil and Refrigerant-22 as well as free oil and free refrigerant.

The practical effect of this set of conditions is to divide into two parts the problem of lubricating Refrigerant-22 systems. In the high side, the oil and refrigerant behave as in a Refrigerant-12 system. The viscosity of the complete oil-refrigerant mixture determines the lubrication efficiency.

In the low side, however, the low-temperature separation discussed previously makes it necessary to *take all precautions to keep oil out of the capillaries* or expansion valves, and evaporator tubes where free oil would congeal as temperature falls below the pour point of the oil. Obviously, such congealed oil would not only cause congestion in the system, but would not be in condition to flow back to the compressor. This requires a two-step remedy: the oil entering the low side must be minimized by placing an oil separator in the line between the compressor and condenser. Since this cannot be expected to be 100 per cent effective, small percentages of the oil will still be carried over into the evaporator. Design provisions can be made for periodic heat application by circulating hot gas, or by electrical units, to prevent congealing of oil.

Mixing two Refrigerants.—A trick of the trade has been successfully developed to keep this stray oil from congealing, even at temperatures below —120 deg. The regular charge of Refrigerant-22 should include up to 3% of Refrigerant-12. This small addition of Refrigerant-12 will remain in solution with the oil, which can then pass through the system without congealing.

Some slight reduction of volumetric efficiency results, but this is a small price to pay for making the Refrigerant-22 system more workable. Some manufacturers of the Refrigerant-22 type of refrigerant now furnish, on order, cylinders of this refrigerant already mixed with the 3% of Refrigerant-12.

PROPER HANDLING OF REFRIGERATION OILS

During the manufacture and packaging of refrigeration oils, as previously noted, the refiner takes every precaution to exclude dirt and moisture, so that the effect of clogging due to ice formation, or corrosion, or copper plating, is minimized and trouble from these sources is reduced to very infrequent occurrences. In addition, the new process of dual-inhibiting further increases reliability of performance under severe operating conditions.

However, all these good features in modern refrigeration oils can be lost if proper care is not taken in the handling of the oil in the shop. After you have once opened a container of top-quality refrigeration oil, it is up to you to maintain this top quality as it is used by keeping it clean and dry. Here are a few helpful hints

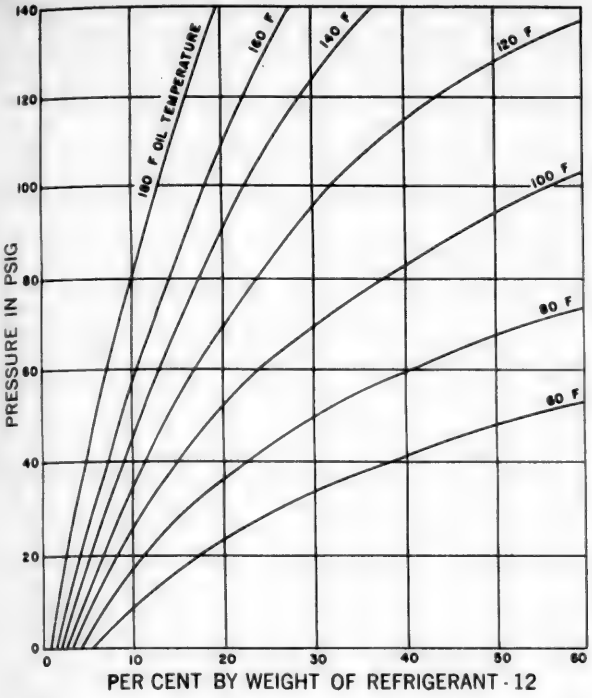

Fig. 2. Solubility chart, Refrigerant 12 in Type B oil.

on proper oil handling:

1. Avoid the use of dirty tools to pry off the seal under the screw cap.

2. Replace the cap as soon as you have drawn off the oil needed. Oil in an open can will absorb moisture from the surrounding atmosphere.

3. Do not pour the oil into any other container unless it is absolutely necessary to do so. If you must use another container, be sure it is clean and dry.

4. Use clean tools. A funnel or a piece of tubing that is almost clean may still be dirty enough to cause trouble.

5. If you suspect that dirt has gotten into a can of refrigeration oil, discard the entire can. Your reputation, and the cost of repairs or down time, are certainly worth more than the price of a can of oil.

6. If you have any reason to believe that the refrigeration oil has picked up moisture, or that the system you're working on contains excessive moisture, install a dehydrator or drying cartridge and follow the manufacturer's instructions for its use. Such driers or cartridges, when properly used, are highly efficient.

Lastly, do not use any refrigeration oil in your refrigerating or air-conditioning system until you are sure that it is the right oil for the job, following the criteria for refrigeration oils set forth in this article.

Lubricating Systems

There are two general types of lubricating systems designed to furnish the most efficient lubrication for refrigerator compressors.

Open-type Compressors. In open-type compressors with open crankcases, the oil is withdrawn from the system. The units are usually large horizontal industrial compressors used in ice plants and in industrial processes, and are frequently equipped with separate systems for the lubrication of cylinders and bearings.

In open-crankcase type compressors operating in a horizontal position, lubrication is provided by two systems:

1. Piston and piston rod lubrication is supplied by a pressure system which injects predetermined amounts of oil to stuffing box gland and cylinder.

2. Bearing lubrication is provided by lubricating systems such as force-feed, gravity, or splash.

Well designed systems are provided with an oil separator on the discharge line which separates the oil entrained in the high pressure gas as it travels to the condenser. If entrained oil in the high pressure gas is carried into the condenser, it will adhere to the walls, thereby reducing the efficiency of the condenser.

A lighter oil is used for cylinders than for the lubrication of bearings, where the oil is exposed to greater pressure.

The oil for cylinder lubrication of refrigerator compressors is not consumed to any considerable degree and remains in the cylinders a long time. Therefore, any excess oil should be avoided for otherwise it will form a coating in the expansion coils and decrease the efficiency of the system.

Closed-type Compressors. In closed-type compressors, the same oil serves for the lubrication of bearings and cylinders and remains in the system. A heavier grade of refrigerating oil must be used in such machines.

All industrial compressors, especially those of the older type which have been in service for some length of time, should be carefully inspected for worn parts, and, if advisable, heavier oils should be recommended in such cases in order to avoid an excess of oil being pumped into the expansion coils and mixed with the refrigerant vapors. This entrained oil can be removed by any suitable oil separator.

LUBRICATION OF INDUSTRIAL COMPRESSORS

In large vertical or horizontal refrigerator compressors, pressure lubrication is extensively used. Splash lubrication is better adapted to vertical compressors.

Pressure lubrication permits more accurate control of the amount of oil delivered to cylinder walls and to bearings, but requires considerable piping and frequent attention by the operator, who has to refill the reservoir and regulate the flow of oil.

Mechanical Force Feed Lubricators

Cylinders and bearings are extensively lubricated by means of mechanical lubricators.

A mechanical lubricator consists of a small rectangular tank, divided into several compartments, located at a level above the parts to be lubricated. It is fitted with a plunger mechanism, operated from cams or levers which are connected with some rotating parts of the compressor. When the compressor is in operation, the plungers pump the oil through check valves into feed lines to certain points in the cylinder walls, to bearings, and to all other moving parts. The amount of oil can be regulated by adjusting the plunger stroke.

Frequently, different grades of oil are contained in the compartments of the lubricator for lubricating of compressor cylinders.

Force-feed lubricators for refrigerator compressors

should not be open to the air, in order to prevent moisture from entering the system and freezing at the low temperatures encountered. On the other hand, they should meter the lubricant and deliver it regularly to all points to be lubricated in minute, predetermined quantities. The amount supplied by each unit can be seen in the sight-glass. Any excess of oil might tend to cause carbonization at some of the hot spots frequently occurring in large industrial compressors. Care must be taken that the oil feed lines are filled before operation of the compressor begins. For this purpose, a manual handcrank is usually part of the lubricator; this can also be operated when it is found necessary to increase momentarily the supply of oil to certain points.

In large horizontal and vertical compressors with crossheads, internal parts, cylinders, pistons, and rods are lubricated by mechanical lubricators with low pour test refrigerating oils, while external parts such as bearings, pins, crosshead guides, governors, etc., are serviced with machine oils by an independent gravity or pressure circulating system.

In the smaller horizontal compressors, oil is introduced at the top-center of the cylinder.

In double-acting compressors the oil is introduced in the middle of the cylinder, and the piston covers the oil parts during its travel. Automatic valves keep the oil in the feed lines by checking back pressure during the compression stroke.

In some systems, the injection method is used. The oil is injected into the suction line and a spray of oil is carried into the cylinders by the flow of gas and forms a film of oil over all exposed surfaces. This method is rather wasteful, and there is always danger that excess oil will cause sticky valves.

In practically all compression machines with reciprocating parts, the oil serves also as a seal in the stuffing boxes. Hot ammonia gas has a very bad effect on the packing of stuffing boxes, and sufficient lubricating oil should be used to prevent overheating.

Piston rods must be properly lubricated to prevent wear and leakage of gas. Lubrication is accomplished in a stuffing box with oil seal. Generally, an "oil lantern" is located between two sets of packing. It is a hollow space surrounding the rod, into which the oil is pumped through an opening from a reservoir. From the lantern, the oil flows through the packing; another opening from the lantern is connected with the suction side of the compressor and any gas which leaks by the packing rings is returned to the cylinders. A well-lubricated piston rod is bright and smooth and covered with a thin film of oil.

In some types of double-acting compressors, the oil lantern serves also to feed the lubricating oil to the compressor cylinder. The oil penetrates past the piston rod packing, at the same time protecting the packing from the bad effects of the ammonia.

Ammonia and carbon dioxide compressors are very similar to each other as far as construction and operation are concerned. The working pressure of carbon dioxide compressors is higher (from 900 to 1,000 psi) and consequently the cylinder temperatures also are higher.

In both types of compressors, the lubricating oil must stand up under severe service. It must not carbonize at the high temperatures in the cylinders and must have sufficient body (viscosity) to supply a protective film

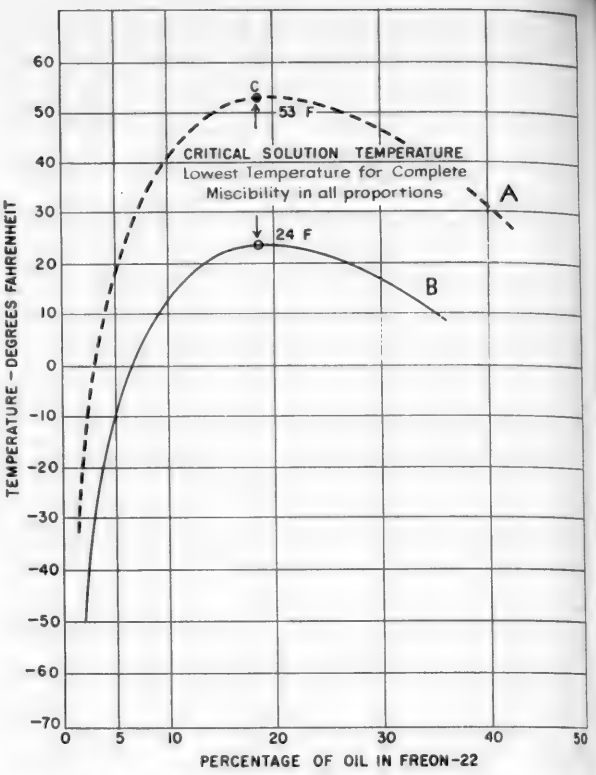

Fig. 3. Solubility chart, Refrigerant-22 with Type B oil and Refrigerant-22 with Type A oil.

on all frictional surfaces. It must readily drain into the traps at the low temperatures of the refrigerating systems.

When CO_2 refrigerating machines are operated in the production of dry ice, a white oil may be furnished. Dry ice is frequently used in direct contact with food products and for this reason some operators insist on a water-white oil which will have no effect on the odor or color of the dry ice in case an appreciable amount of oil should pass the traps and mix with the dry ice. To avoid such possible contamination of the dry ice, some operators are willing to sacrifice the slightly better lubricity of the pale oils.

Oil Separators

Most industrial refrigerating systems are equipped with oil separators to aid the separation of the oil from the refrigerant, or oil interceptors located between discharge valve and close to the condenser. They are generally cylindrical tanks with baffles and a sight gage glass to indicate the level of the oil. Any particles of oil mixed with the gas after it has left the compressor are precipitated in the separator. If the refrigerant is much lighter than the oil and is not miscible with it, the oil will separate by gravity in the receiver.

Lubricating Systems

Every compressor manufacturer has his own system of lubrication or a combination of systems, which serves his equipment best. For instance, we find in some older types of steam driven horizontal refrigerator compressors, a splash system for cylinder walls and piston lubrication and oscillating mechanical lubricators for lubrication of external parts. In some of the latest models, oil is pumped

from the crankcase into a sump and from there circulated under pressure and returned through filters to the crankcase. In others, a mechanical lubricator forces engine oil to bearings and cylinders. In some systems, the lubricating oil is also used to regulate the operations of governors with automatic cut-offs. An oil pump, chain-driven from the main shaft, takes suction from the crankcase and forces oil under pressure, acting against the governor plunger. The oil pressure is increased or decreased by the variation in the steam pressure and speed of the compressor, causing a movement of the rack and weight which is part of the governor, and by means of a diaphragm-operated valve which bypasses part of the oil flow. The change in oil pressure thus effected controls the speed of the unit according to load demand.

Another modification of force feed lubrication on large industrial compressors embodies a chain-driven gear pump which furnishes positive pressure lubrication. Oil from the reservoir enters the pump intake through a strainer and is discharged from the pump to a screen-type filter which can be cleaned while the compressor is operating. Before being distributed to the bearings, the oil is passed through an oil cooler, assuring cool, clean oil for all bearings. The oil is distributed through drilled passages or oil lines to the bearings, crosshead pins and guides. Excess oil from the pump is by-passed to the main reservoir or to the oil sump by a relief valve.

Automatic devices stop the compressor in case of oil pressure failure from any cause.

New Compressors

A new compressor requires more oil for cylinders and bearings until it is well broken in and the surfaces requiring lubrication have become smooth and coated with an oil film. It is advisable to drain all the oil and clean the crankcase carefully of all dirt, metallic particles and lint, and refill it with clean, fresh oil. After the compressor has been started again and is running, the oil level in the reservoir should be carefully watched and oil added until the oil level is several inches above the intake pipe; this is marked as the low level when the compressor is running. If the compressor is shut down and the oil has drained back into the reservoir, the oil level is marked as "low level—idle", and after adding oil another level is established for "high level—idle." After the compressor is started again, the resulting oil level is marked as high level-running.

Frequency of change of oil depends on operating conditions and time-efficiency of operation. Most manufacturers of large heavy-duty compressors recommend oil change at least every 90 days.

Instruction books furnished by each manufacturer should be studied and followed carefully by the lubricating and operating engineer.

SPLASH LUBRICATION

Smaller industrial and commercial vertical refrigerator compressors have enclosed crankcases. Cylinders, pistons, and bearings are lubricated by a splash or circulating system. In the splash system, the refrigerating oil (for cylinders and bearings) is stored in the crankcase at such a level that the crank dips into the oil at each revolution and splashes a sufficient amount of oil spray to the cylinder walls and pistons. An excess of oil in the crankcase would cause violent agitation or churning of the oil by the crank, which would prevent precipitation of any foreign matter which might be in the system and could have a detrimental effect on the lubricating oil. Such excess oil might also enter into the condensing and evaporating system and cause operating difficulties of the entire refrigerating machinery.

Refrigerating oil for splash systems must have sufficiently high viscosity at compression temperature to prevent excess oil consumption. Too light an oil will pass by the piston rings. Since air can enter into commercial refrigerating systems, the oil must be resistant to oxidation and very stable, in order to reduce formation and deposition of carbon and gum to a minimum.

Such excess oil could also work its way into the cylinders and pass piston rings (especially if the latter are worn or not fitted tightly) to get into the refrigerating lines and prevent efficient operation of the oil separator.

LUBRICATION OF BEARINGS

On large heavy duty refrigerator compressors, a gear pump or motor driven centrifugal pump forces oil to a header supplying oil to the bearings.

Floor lubrication (splash system) is also used. When the compressor is in operation, the oil is struck by the crank disc and is thrown in heavy clouds to all parts of the interior of the crankcase. The crank and crosshead bearings are constantly flooded with oil and a portion of the oil drains to the main bearings. All oil drains back to the reservoir and is used over again. Openings in the oil shields facilitate inspection of the lubricating system while the compressor is in operation. Through a drain pipe at the bottom of the oil reservoir the crankcase oil can be drawn out.

In vertical refrigerator compressors employing splash lubrication, the same refrigerator oil is used for the lubrication of cylinders and bearings.

In medium sized industrial refrigerator compressors, bearings, crank pins, and guides, are lubricated by a splash or force feed lubricating system. Large industrial horizontal or vertical refrigerating compressors use an independent gravity pressure circulation or force feed lubricating system.

A gravity circulating system generally has an oil reservoir at a higher level from which the oil flows by gravity to the different bearings; from there it drains to a lower reservoir and is pumped back through a screen or filter, to remove any impurities, to the upper reservoir and used over again. If the oil is contaminated with water, it should go to a separator before it is pumped back to the reservoir.

In the force feed lubricating system, oil is pumped to the bearings from a central reservoir, and it drains back by gravity to the reservoir. The same precaution for cleaning the oil should be taken as in the gravity system.

Bearings are frequently lubricated also by ring and chain oilers. The lubricating oil acts also as a cooling medium because it removes part of the frictional heat developed in the bearing.

A ring oiler consists of a machined ring of a larger diameter than the journal; the ring rotates with the journal and dips into an oil reservoir, located beneath it, picks up the oil, and carries it up to the bearing surface, which generally has oil grooves for the distribution of

the oil over the entire surface. The excess oil is removed by a wiper or scraper, or is thrown on the housing and runs down on the journal and back into the reservoir. The level in the oil reservoir must be maintained sufficiently high so that the ring always dips fully into the oil. Ring oilers are used for the lubrication of outboard crankshaft bearings of industrial reciprocating compressors and of rotor bearings of centrifugal compressors.

The oil acts also as a shaft seal, where the shaft passes through the casing in combination with the lapped metallic seals customary in centrifugal compressors. This arrangement prevents air from entering the system and the loss of refrigerant into the atmosphere.

In the centrifugal type design, such as Carrier Corporation units, oil is supplied to the seal by pressure during operation, and the metal seal faces are separated by oil pressure; when the compressor is not operating, a metal-to-metal seal is made under oil.

Chain oilers operate on the same principle as the ring oilers; an endless chain rides on the journal, dips into the oil in the reservoir, and brings it to the bearing surface.

Outboard bearings are also lubricated with "sightfeed oilers". They consist of a cylindrical cup filled with lubricating oil, which flows through a tube into a hole in the bearing. A glass is inserted in the oil tube so that the flow of oil is visible and can be regulated by a needle valve inserted into the oil tube.

The lubrication of electric motors, gas, oil, and diesel engines serving as prime-movers for the operation of industrial, commercial, and domestic refrigeration compressors, does not differ from the practice followed in other services.

LUBRICATION OF AIR CONDITIONING EQUIPMENT

Unit Systems. The lubrication of small unit-type air conditioning equipment using mechanical lubrication is very similar to that of the sealed domestic refrigerating unit. It is expected to give service during the life of the unit. The original charge of refrigerating oil and any necessary service is, and should be, taken care of by the manufacturer or dealer from whom the equipment was purchased.

In railroad, truck, bus, and airplane service, which places a much heavier load and more severe service conditions on these small units, regular inspection and overhaul periods are customary while such carriers are in the shops for inspection and repair. Skilled mechanics, generally factory trained, attend to these air conditioning units. Refrigerator oils specific for the lubrication of these units are purchased in sealed containers and are kept in stock by the operators.

Commercial Units. In commercial units of small tonnage, splash-lubrication is mostly used for the enclosed type vertical reciprocating compressor.

Centralized Systems. In large centralized systems (theatres, hotels, department stores, hospitals, industrial plants and office buildings), pressure lubrication is used in the large type horizontal and vertical compressors for the lubrication of cylinders and piston rods. In some designs an overflow pipe from the stuffing-box oil lantern carries the oil to the suction line, and the oil is delivered to the cylinder with the refrigerant.

Force feed lubricators are also used advantageously. Some designs of compressors in this service contain an enclosed type of force feed pump located on the bottom of the crankcase and driven from the main shaft. Such a pump always has positive suction and delivers oil through feed lines to all moving parts under positive pressure.

Motor and Fan Lubrication. The bearings of motors and fans, which are essential for the proper distribution of the cooled air, are mostly of the anti-friction type; their lubrication is identical with such bearings in industrial use. The lubricant must protect the highly polished surfaces from pitting and corrosion; it must seal the housing against foreign matter (dirt and water) and must support sliding and rolling contact within the housing. Oil or grease serves as lubricant. The recommendations of the manufacturer of such bearings, which are based on the service, operating conditions, speed, and temperature, should be followed.

Air Filters. Before air is conditioned for circulation, dust and dirt should be removed. Various types of filters and cleaners, which have to clean the air thoroughly without offering too much resistance to the flow of air, are used for this service. Some types of these filters in large air conditioning systems, employ a viscous oil film to hold dust and dirt; the coating which gradually accumulates and would render the filters inefficient is removed periodically, and the cleaned filter dipped in oil, or the oil is sprayed on the filter medium. Self-cleaning automatic filters are available. The unit-screen panels rotate continually through an oil reservoir at the base of the filter, and the dirt is washed off and accumulated in a sludge pan from which it can be removed. The oil in the reservoir is changed periodically, whenever it becomes too saturated with dirt.

Other methods of air cleaning use special composition filters (for small units), air washers and centrifugal filters.

Well-refined refrigerator compressor oils for low temperature operation and good grades of light engine oils for warm air are recommended by the filter manufacturers. These oils must be practically odorless so as not to impregnate the filtered air with a petroleum odor, which might be objectionable to the public in theatres, office buildings and hospitals.

New Units. It is customary to break-in new units with a refrigeration oil of lighter viscosity than is used in regular operation; this oil of lighter viscosity is known as break-in oil.

Fire Protection System Design for an Industrial Plant

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Part 2 of a two-part article covering the important components of fire protection for an industrial plant. This part deals with various types of sprinkler systems, water application equipment and fire detection devices.

SPRINKLER systems for general protection of a building and its contents may be of the following types: Wet pipe system; dry pipe system; pre-action system; deluge system; combined dry-pipe and pre-action sprinkler system; limited water supply system.

Where special protection is required for equipment, the engineer should consult with reputable manufacturers of fire protection equipment.

Wet pipe sprinkler systems, as shown Fig. 10 are most commonly used in buildings which are not subject to freezing temperatures, and are subject only to light or ordinary fire hazards.

The wet pipe system consists of approved type automatic sprinklers connected by graduated piping to an alarm valve in a main riser which is connected to the water supply. The pipes are normally filled with water.

When a fire causes one or more sprinklers to open, water immediately flows to put out the fire, and at the same time causes an alarm to sound.

The number of heads and the size of piping to be provided is governed by the type of occupancy hazard. For light occupancy hazard and smooth ceiling construction, up to 200 sq. ft. per sprinkler head may be approved; for ordinary occupancy hazard, 130 sq. ft. per sprinkler head; for extra occupancy hazard up to 90 sq. ft. per sprinkler may be acceptable.

These are maximum allowable areas per sprinkler and for preliminary estimates and layouts about 75% of this coverage should be allowed. For ordinary occupancy hazard, the following size risers should be provided:

100 sprinklers — 4-inch pipe	160 sprinklers — 5-inch pipe
275 sprinklers — 6-inch pipe	400 sprinklers — 8-inch pipe

Using these or corresponding figures for other occupancy hazards, the number of risers required and their location may be determined. Each riser should be equipped with an approved type of alarm valve. Risers should not be located adjacent to windows or where they may be subject to freezing or mechanical injury.

A dry pipe system, Fig. 11, is commonly used in a building which is not only subject to light or ordinary occupancy hazards, but is also subject to freezing temperatures.

It consists of approved type sprinklers connected by graduated piping to a normally closed dry pipe valve. Air under 25 to 40 psi is maintained in the piping system between the sprinklers and dry pipe valve. When a sprinkler head opens, the air is released and as the pressure drops the unbalanced water pressure opens the dry pipe valve, causing an alarm to sound and water to flow to the sprinklers.

A small independently operated air compressor should be provided to maintain the necessary air pressure at all times, except when a head opens, to prevent the water pressure opening the dry pipe valve. The compressor should have adequate capacity to restore the normal air pressure in the system within thirty minutes.

As water must displace the air in the sprinkler piping, a dry pipe system is somewhat slower than a wet pipe system in supplying water to a fire.

A quick opening device called an accelerator is required for each standard dry pipe valve controlling more than 400 sprinklers. Not more than 600 sprinklers should be controlled by one dry pipe valve.

The dry pipe valve and the supply piping to it must be protected from possible freezing. For this purpose, a small electrically heated enclosure may be provided for the valve and the riser below the valve.

A pre-action sprinkler system is suitable for small unheated areas such as shipping platforms where there

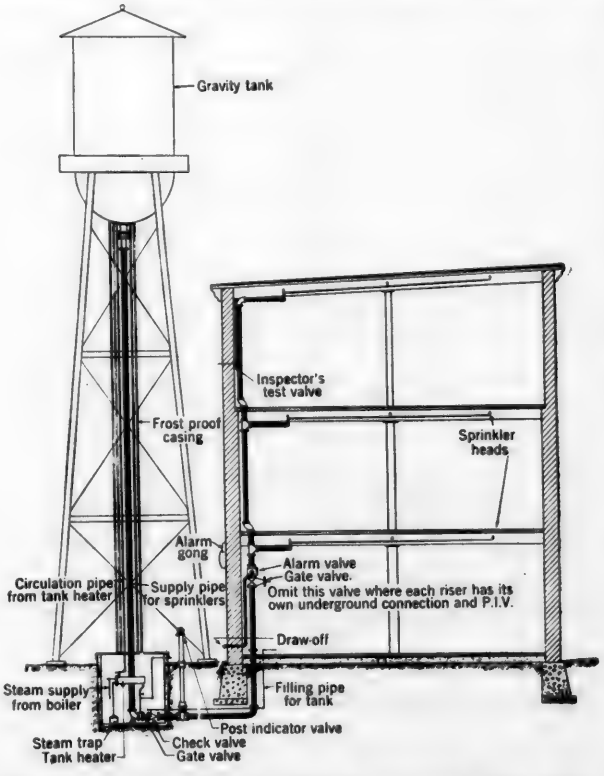


Fig. 10. Cross section of building equipped with automatic sprinklers connected to gravity tank.

are light or ordinary fire hazards and where not more than about 25 sprinklers are installed. This type system is much faster in operation than a dry pipe system.

Approved type automatic sprinklers are connected by graduated piping to a pre-action valve in the supply line to the sprinklers. The pre-action valve is normally closed and there is no water in the piping between this valve and the sprinklers.

A sensitive heat-actuated device, such as a rate-of-rise unit located in the same area as the sprinklers, senses a fire in advance of the operation of the sprinklers, and immediately sounds an alarm and opens the pre-action valve admitting water to the sprinklers. If the fire is not extinguished manually, water is immediately available when the sprinkler heads open.

A deluge system is commonly used for the protection of small extra hazard areas such as small spray booths and drying tunnels.

This type system uses open sprinklers connected by graduated piping to a quick opening valve, called a deluge valve, in the water supply to the system. The operation of the valve is controlled by a heat sensitive element of the rate-of-rise or fixed temperature type located in the area to be protected. In case of fire, the heat detector equipment causes an alarm to sound and the deluge valve to open. This type system is very rapid in operation and may be used in unheated areas.

A combined dry pipe and pre-action sprinkler system may be used where a wet pipe system is impracticable and where a number of dry pipe valves would be required.

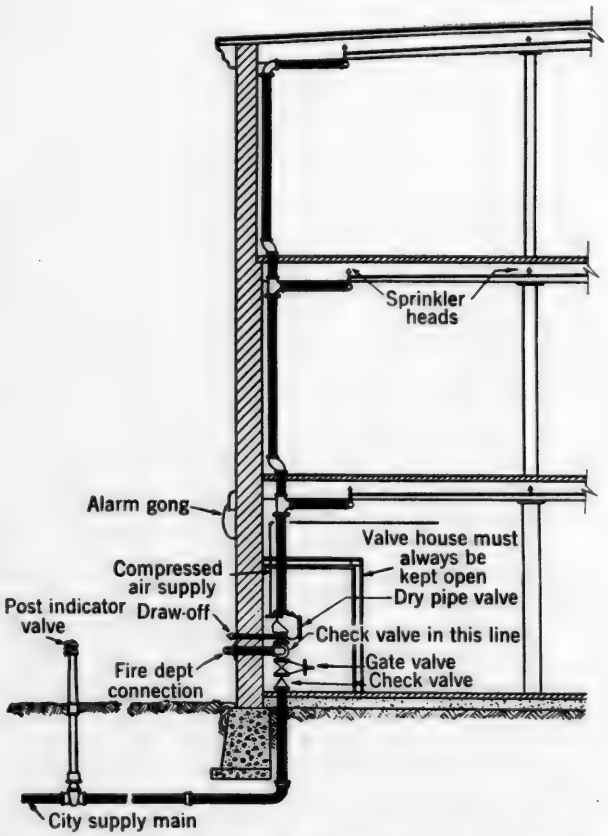


Fig. 11. Cross section of building equipped with dry pipe system of automatic sprinklers.

As with a dry pipe system, approved type automatic sprinklers and a graduated piping system containing air at 25 to 40 psi is connected to a dry pipe valve, or to two valves if a total of more than 600 sprinklers are required or if there are more than 275 sprinklers in any fire area.

The system is also equipped with an exhauster which automatically, rapidly and positively removes the air from the system when the heat responsive element trips the dry pipe valve.

When two dry pipe valves are required, each must be provided with a check valve. As the opening of the dry pipe valve does not have to wait for loss of air pressure through open sprinkler heads, the system will go into action as soon as the sprinkler head opens. The system should be so designed and constructed that water will reach the furthest sprinkler in not more than one minute for each 400 ft of common feed main, from the time the heat responsive equipment operates, and in no case more than three minutes. The pre-action system also causes alarm equipment to operate.

A limited water supply system, as shown in Fig. 7 (ACH&V, Sept. 1958, p 56) is used for light and ordinary hazard occupancies where a predetermined limited water supply is expected to control the fire. It consists essentially of a system of automatic sprinklers supplied by a pressure tank of capacity suitable for the fire hazard and located where desirable. Pressure in the tank for operation of the system is maintained by a compressor. The water flow causes an alarm to sound. The operation of the system may be initiated by fixed temperature automatic sprinklers, or by rate of rise equipment.

For further information on sprinkler systems, see NFU Standards No. 13 for Sprinkler Systems and Rules for Installing Sprinkler Equipments by the Inspection Department of the Associated Factory Mutual Fire Insurance Companies.

Standpipe systems are commonly provided to supplement sprinkler systems and provide means for obtaining effective fire streams in the shortest possible time, especially at the upper stories of high buildings. The standpipes may be provided for fire department use or used by trained personnel to handle heavy fire streams. They can be used as first aid protection by occupants of the building, or for both types of service.

Standpipes normally are under water pressure at all times, but may be designed for admission of water automatically by opening a hose valve or through manual operation of remote control devices at each hose station. They may also be dry systems designed only for use with fire department pumping equipment.

Standpipes for use with first aid hose should be not less than 2-inch dia for buildings not more than four stories or 50 ft high, and 2½-inch for buildings in excess of these figures.

Standpipes for 2½-inch hose should be not less than 4-inch for buildings not exceeding 6 stories or 75 ft high, and 6-inch for buildings in excess of these figures.

The number of standpipes to be provided in each fire area should be sufficient so that all portions of each floor are within 30 ft of the nozzle on a 100 ft length of 2½-inch hose, or within 20 ft of the nozzle for a 75 ft small size hose.

Standpipes should be located where they are protected against mechanical or fire damage and where they are

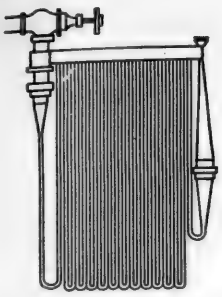


Fig. 12. Underwriters' fire hose rack.

readily accessible, preferably in stair wells with outlets within the stairway enclosure.

In large buildings small first aid hose risers should be located at the interior columns. Dry standpipes should not be concealed.

Hose connections should be provided outside the building for use by the fire department. These are usually of the siamese type equipped with a check valve and an automatic ball drip. For further information on standpipe and hose systems see NBFU Bulletin No. 14, Standpipe and Hose Systems.

Water Application Equipment

Effective application of water to a fire, when and where needed, is essential, and the following equipment is required.

Hose Houses and Equipment

Hose houses should preferably be provided at each hydrant, but well located portable hose reels and equipment may be approved as a substitute.

Hose houses should be of substantial construction on adequate foundations designed for protection against weather and vermin, and for easy access to hose and other equipment.

The hydrant should be located near the front, and shelves or racks should be provided for hose and equipment. At least 100 ft and preferably 150 ft of 2½-inch cotton rubber lined hose should always be attached to the hydrant. Nozzles, crowbars, axes, wrenches and spanners should be provided as listed in NFPA Bulletin, No. 24, Outside Protection.

Hose Racks and Reels

Each outlet on standpipes inside a building should be equipped with a hose rack, or reel and hose. All equipment and hose should be of a type approved by the Underwriters Laboratories. Hose racks may be of the exposed type, Fig. 12, or in suitable cabinets built into the building.

Hose racks should preferably be of the semi-automatic type. To use this type rack, the hose valves are opened wide, the nozzle grasped firmly, and the hose pulled toward the fire. The water is automatically released as the last few feet of hose are pulled from the rack.

Non-automatic racks require the services of two men, the first to pull out the hose and the second to open the valve as soon as the hose is completely off the rack and directed toward the fire.

Each hose valve on a wet system should be provided with a suitable open or automatic drip connection to carry off any slight leakage through a valve, and prevent the leakage from reaching the hose.

Hose should be unlined, linen hose. Linen hose depends upon the tightness of the weave of the fabric to hold water, and when the water is first turned on there may be some seepage until the fabric becomes saturated.

Nozzles for large hose should be 1 to 1⅛-inch, and should be provided with swivel handles. Nozzles for small hose should be not over ½ inch without handles.

Combination nozzles, which give a spray or a solid stream, may be used where the use of a solid stream may spread the burning material or where a spray stream is desirable, as when fighting flammable liquid fires.

In locations where moisture conditions would adversely affect unlined linen hose, cotton rubber lined fire hose on swinging fire hose reels may be provided, but this type of hose should be protected from heat and should have water passed through it at least four times a year to keep the rubber lining in good condition.

Sprinklers

Sprinkler heads which have been approved by the Underwriters Laboratories include: Link and lever, frangible bulb, heat collector, chemical and open types.

Heads may be plain, ornamental, wax coated or lead coated. They may be used for upright, pendant or sidewall installation. Standard automatic sprinklers have ½ inch discharge orifices of ring nozzle types, or 7/16 inch tapered nozzle orifices.

They are also made for various temperature conditions as listed in Table 1.

Open sprinklers are also available for special systems or types of exposures. Upright sprinklers are commonly installed about 4 to 8 inches below smooth ceilings or joists, under joisted construction.

Pendant heads are commonly used on wet-type systems where it is desirable to conceal all piping above the ceiling. Where practicable, they should be connected to the tops of the branch piping.

With hung ceilings of insulating material for single story buildings, or at the top of a multi-story building, it may be necessary to provide some heat above the ceiling during extremely cold weather.

Pendant heads are not generally approved with dry type systems unless equipped with special type nozzles which prevent the entry of water or rust into the nipple until the sprinkler opens. For special systems requiring spray protection, self cleaning strainers may be required. Water enters at the bottom through a strainer cylinder and leaves at the top. Provision is made for flushing the dirt and foreign matter collected in the strainer by operation of a quick opening valve.

Fire Detection

To prevent a serious conflagration, it is generally essential that a fire be detected in the very early stages. While this may be possible without special equipment in many fires which occur at times when they may be readily observed, others may start in locations which are not under constant observation, or when there is no one around to spot them.

Reliable automatic devices are therefore needed to sense the fire, to give an alarm and, in some cases, to put fire protection equipment in operation.

Automatic sprinkler heads are the commonest of such devices. Heat sensitive elements operate within a very closely predetermined temperature range to permit a water

TABLE I—OPERATING TEMPERATURES FOR SPRINKLER HEADS

Max. Room Temp at Ceiling, Deg F	Rating Designation	Operating Temperature, Deg F		Color
		Non-solder type	Solder type	
100	Ordinary	135-150	155-165	Plain bronze
150	Intermediate	175	212	White
225	Hard	250	286	Blue
300	Extra hard	325	360	Red
375	Extra hard	400*		Green
475	Extra hard	500*		Orange

* Available only in Quartzoid type

flow for extinguishing the fire and this water flow operates suitable alarm mechanisms.

Rate-of-rise equipment does not operate on a fixed temperature, but functions when there is a rapid rise in temperature as at the start of a fire. The heat sensitive elements are small hollow brass chambers which are fastened at intervals to the ceiling and connected to a release by air tubing which is also provided with a compensating vent. When a fire occurs, the rapid rise in temperature causes the air in the brass chamber to expand faster than it can escape through the vent. This builds up a pressure which trips a release that causes valves in water lines to open, alarms to sound, machinery to shut down, fire doors to close, or other operations required for property protection.

Fixed temperature sensitive elements operating at predetermined temperatures may be used to operate similar devices. While devices of this nature are reliable when properly installed and cared for, they should be checked for operation at frequent intervals.

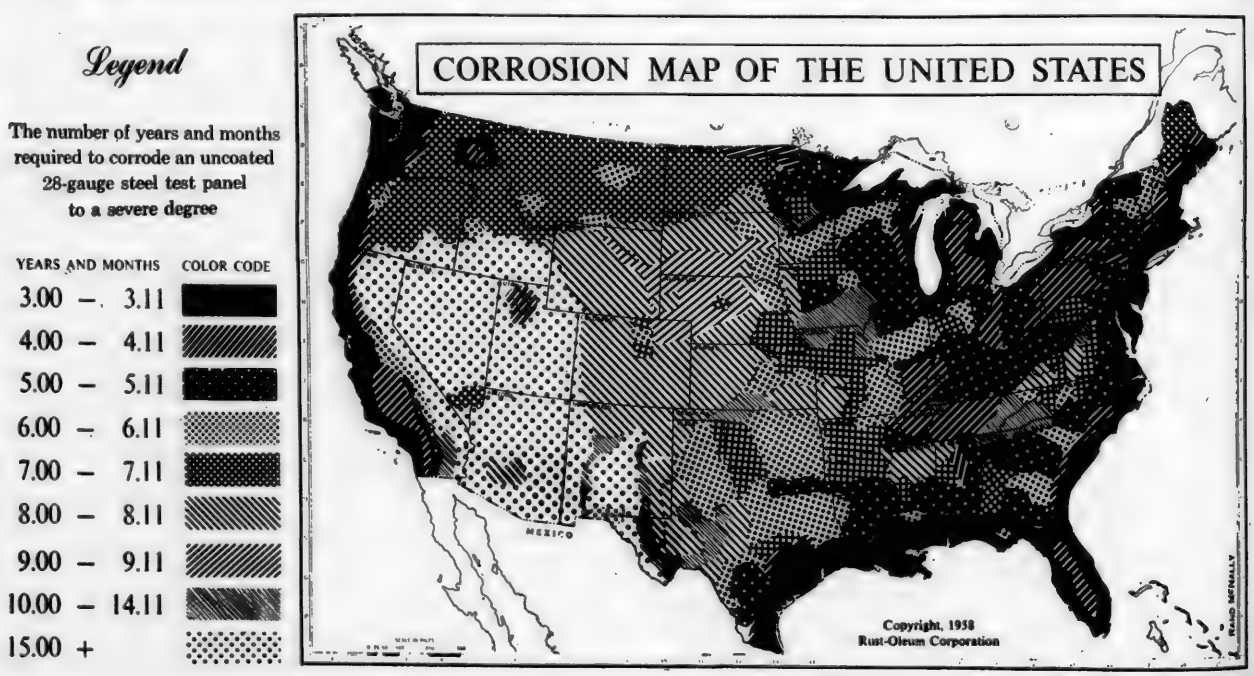
Supervisory systems to give warning in case of unauthorized operation of valves in the fire protection system, or failure of detection equipment to operate, are frequently installed as a precautionary measure. These may be electric or pneumatic, but in any case should be so installed that a warning is given by the opening of the electric circuit, or drop in air pressure on the supervisory system. This guards against failure of the system to operate in case of disconnected wiring or air piping at the equipment to be supervised.

Comparative Rates of Rust

The comparative rates at which rust proceeds in different parts of the country have been established for all United States cities over 10,000 population.

It takes three years, the fastest rate in the country, for rust to corrode a standard, uncoated steel test panel, the size of an auto license plate, in four different cities: Buffalo and Rochester, N. Y.; Erie, Pa.; and Miami, Fla. Slowest rust rate, more than 15 years, is in Tucson, Ariz.; Roswell and Santa Fe, N. M. In all the nation's major industrial centers the rust rate is under four years.

This was disclosed in the first Rust Index of the United States, published by the Rust-Oleum Corp., Evanston, Ill. The Index, the result of a 25-year research program, was based on a survey of dated and uncoated, 28-gauge, low carbon, cold-rolled sheet steel panels which were left exposed at industrial sites throughout the country. Periodic examination of the panels provided the data for the Rust Index and map shown below. The criterion for the Index was the time it took for the uncoated steel panel to rust to a severe degree. Variations in rate result from the different amounts of rainfall, wind, corrosive gases, sunlight, and salt water present.



LOUIS BLENDERMANN ON

PIPING AND PLUMBING

Location of Sillcocks

THE DESIGN of the water distribution system in a building is not complete until the sillcocks or wall hydrants have been incorporated. Sillcocks are as important for the large building as they are for the private residence. For the average residence, at least two sillcocks are required, one in the front of the house and one in the back. For larger residences, additional sillcocks are required and are spaced evenly about the building. In the private residence, sillcocks are utilized for watering the lawn and flowers, washing the family car, and numerous other purposes.

For the larger building, the sillcocks are used for watering the lawn and flowers. If the building is located in the city, the sillcocks are of value in washing the sidewalk and for other varied purposes.

Location of Sillcocks

Figure 1 is an example of where the sillcocks may be placed around a building. This is a light industrial building as may be found in the suburbs of many of our cities. Since the building is situated on a piece of land that is landscaped with shrubs and a lawn, it is necessary that sillcocks be located around the perimeter of the building.

In this instance, the sillcocks are placed approximately 100 ft apart for the average garden hose is 50 ft long and the 100 foot spacing permits reaching all sections of the lawn or planted area.

This type of sillcock arrangement applies to schools, apartment houses, research laboratories and all other types of buildings that are situated in a similar manner.

Types of Sillcocks

There are a number of different types of sillcocks

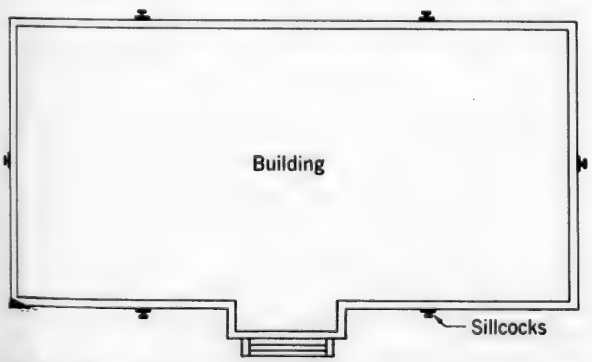


Fig. 1. Plan of a building showing general arrangement and location of sillcocks.

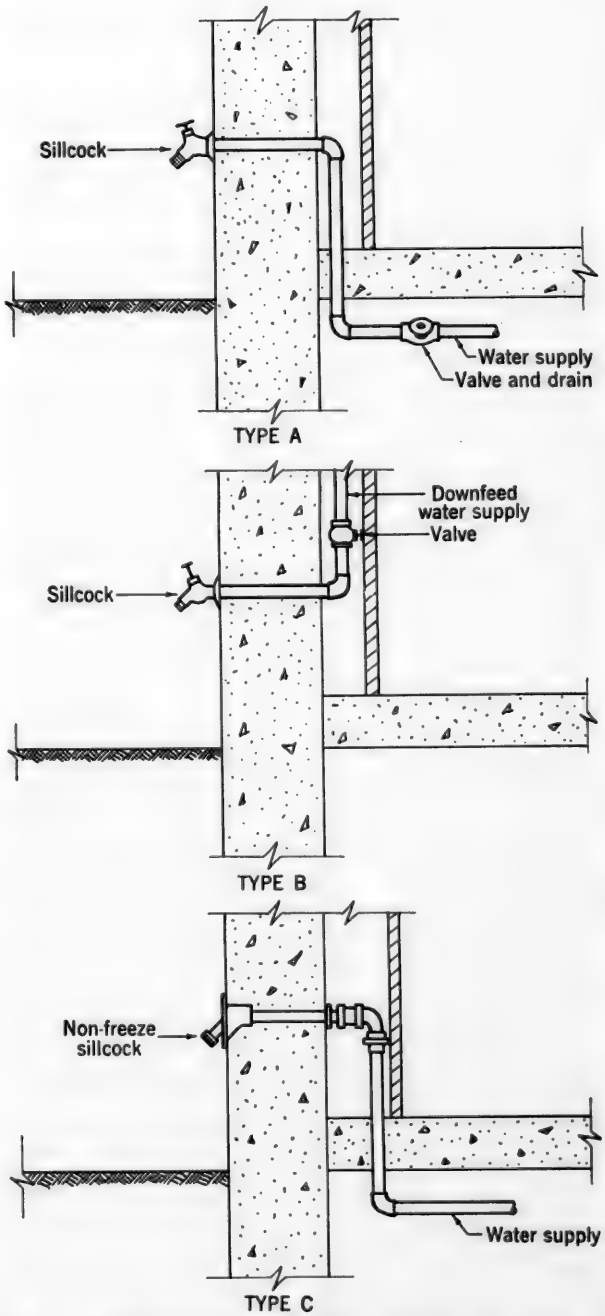


Fig. 2. Different types of sillcock arrangements that can be used.

available. These range from the ordinary hose bibb to the several types of non-freezing sillcocks or wall hydrants. The non-freezing hydrants are intended for areas that are subject to freezing weather. Figure 2 shows the arrangement of several types of sillcocks.

Type *A* of Fig. 2 shows an ordinary sillcock being supplied from the basement of the building. A valve and drain are installed on the water supply line in the basement. In cold weather the water can be drained out of the line between the valve and the sillcock.

Type *B* illustrates how the sillcock and water piping may be arranged when the first floor of the building rests on grade. Here, a valve is installed on the vertical piping as shown and the water in the piping can then be drained out of the sillcock during freezing weather. In warm climates of course, the draining features are not required.

Type *C* shows a non-freezing type of sillcock with only a polished bronze face plate exposed at the exterior wall of the building. Numerous types and styles of both sillcocks are on the market.

Sillcocks can be equipped with either ¾ or 1-inch spigot outlets or hose connections. The ¾-inch size is more generally used. Moreover, sillcocks can be equipped with removable handles for locations where this factor is desired.

Non-Freezing Sillcocks

Where non-freezing sillcocks or wall hydrants are required, they can be furnished in types similar to those shown in Fig. 3.

Detail *A* of Fig. 3 illustrates the type where only an oval face plate is exposed at the exterior wall of the building. A removable key is used to operate this sillcock. The valve seat is installed at the interior of the building as shown. Since the interior of the building is warm there is no danger of freezing. The sillcock piping is secured in place by means of the locknut as detailed. This sillcock arrangement is flexible to fit any wall thickness, and when buying, it is only necessary to inform the manufacturer the wall thickness to be encountered.

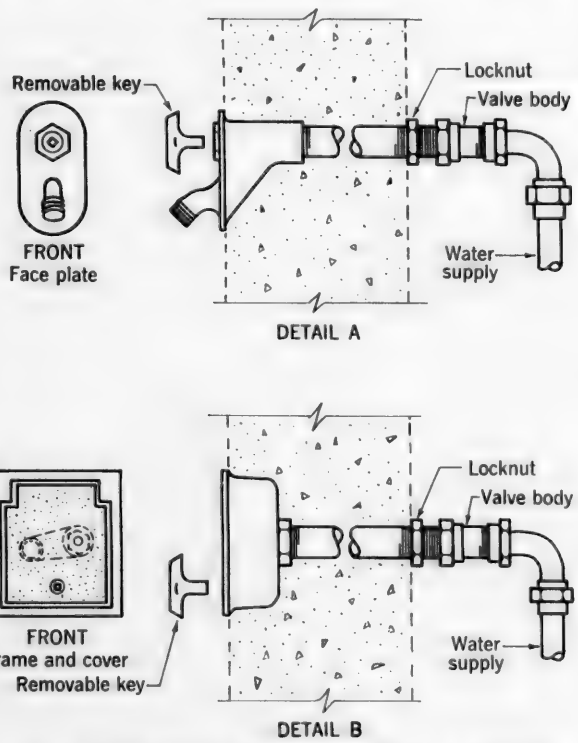


Fig. 3. Non-freezing sillcocks for use in a building.

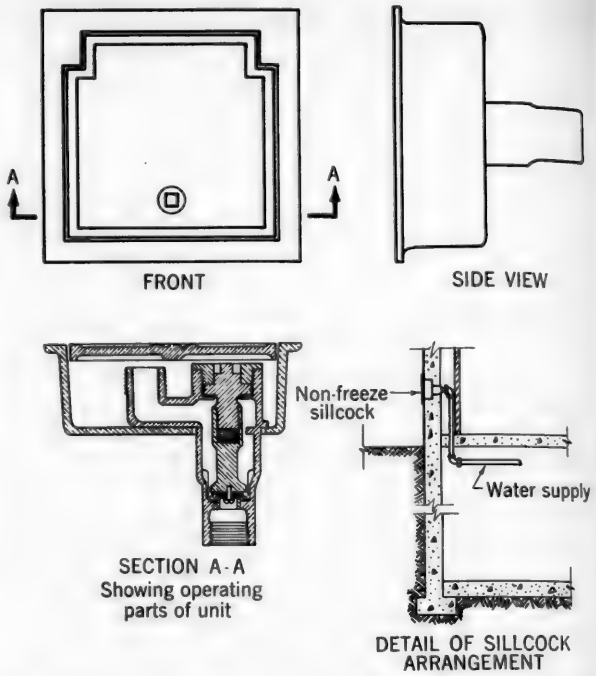


Fig. 4. Details of a non-freezing sillcock that can be used with narrow wall construction.

Detail *B* represents a flush type sillcock or wall hydrant. Here, only a frame and cover is exposed at the exterior wall. The same key that unlocks the cover operates the valve. Otherwise, the valve operates in the same manner as that shown in Detail *A*. The frame and cover may be of polished bronze, rough bronze, chrome plated or other type of finish as desired.

The units shown in Detail *A* and *B* are for example only. There are other styles of the same units that are available.

Narrow Wall Construction

If a narrow wall construction must be accommodated, and a flush type sillcock is desired, the installation illustrated in Fig. 4 may be followed.

Sidewalls in many of the new schools are of narrow dry wall construction. Therefore if a flush type sillcock is needed it must be of narrow proportions to fit the wall construction and the unit shown in Fig. 4 will fit this condition. Actually, it functions in the same manner as the unit shown in Detail *B* of Fig. 3.

The cross section of the unit was included in this instance to show the working parts of the valve. This construction varies with the different manufactured units.

This same type of unit has a broad application at the interior of buildings where it is used in rest rooms, kitchens, boiler rooms, utility rooms and other locations. For these applications it is very practical because it is of the flush type, has a neat appearance, and the cover can be locked with a key.

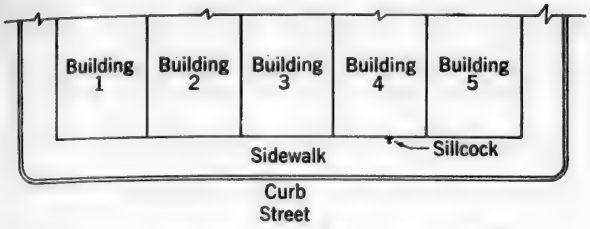


Fig. 5. Typical location of a sillcock for a building in a city.

City Buildings

The sillcocks for buildings located in cities can be any of the types shown heretofore in this article. The sillcock for a building located in the city is generally used for sidewalk washing and it is generally placed in a manner similar to that shown in Fig. 5. Using Building 4 for example, the sillcock would be located as suggested.

Combined Siamese Connection and Sillcock

A combined siamese connection and sillcock is often utilized for city installations. A detail of this type of connection is presented in Fig. 6. The combination is located on the front wall of the building facing the sidewalk. Since a fire standpipe system is generally required for the building, the sillcock is included on the same faceplate. The piping from the sillcock is extended down to the nearest water supply line. A valve and drain are installed on the line to control the supply of water to the sillcock. Here again, several different types of siamese and sillcock combinations are available to satisfy one's precise needs. Removable keys are also recommended for sidewalk installations to avoid tampering. The face of the siamese and sillcock combination can be furnished in a number of different finishes.

Vacuum Breakers

Although the sillcock has many valuable uses it is sometimes used for applications that endanger the water supply in the building. There are many chemicals, solutions and compounds on the market today that have been produced expressly for safeguarding and promoting the growth of lawns, shrubs and flowers.

Weed and crabgrass solutions are applied to the lawns to wipe out and control the undesirable plants that tend to destroy a good lawn. Other solutions are required to destroy the larvae of destructive insects that thrive on the grass roots and soon damage large lawn areas, or are used to spray plants and shrubs to destroy insects that feed on the foliage.

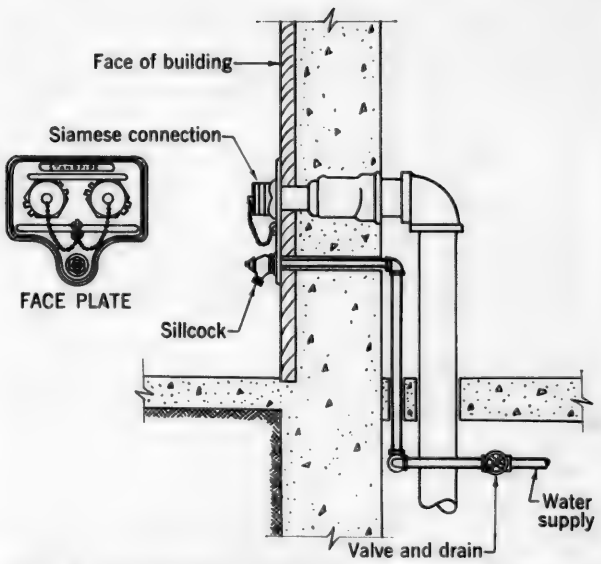


Fig. 6. Combination siamese connection and sillcock.

Often these solutions are applied through a jar that is connected to the hose; it depends upon water pressure for proper mixing and application. In the event of siphonic action, these solutions could be sucked into the interior water supply where they may cause severe stomach disturbances and possibly death. These chemical solutions can be sucked into the line in the following manner. A momentary drop in water pressure either due to pressure drop in the street main or other causes, will create siphonic action at the sillcock. Naturally when the hose is attached directly to the bottle containing the solution, this liquid will also be drawn into the interior water system.

The only answer to this problem is a vacuum breaker. There are a number of different types of vacuum breakers available that may be used with a good deal of success in preventing siphonic action. The vacuum breaker may be placed either at the sillcock with the hose attached to it or it may be placed in the building at a high point on the supply line to the sillcock. In this latter case it is important that the piping be so arranged that the supply to the sillcock is at a higher elevation than the sillcock itself. There is no doubt that in the next few years, a vacuum breaker, either a separate device or a device integral with the sillcock, will be required by most plumbing and health codes. This step certainly will be one in the right direction to further raise the degree of existing health standards.

This monthly column, Piping and Plumbing, was devoted to, in June 1958, the subject of Evaluating Fire Protection Equipment, in which the definition of Class B and Class C fires were interchanged to simplify the tables offered with the article. Our attention has been directed to this matter by an executive of the National Fire Protection Association who feels that a certain amount of confusion might result from this change in basic designation.

The classification of fires according to the National Fire Protection Association is as follows:

Class A Fires—fires in ordinary combustible materials where the quenching and cooling effects of quantities of water, or solutions containing large percentages of water, are of first importance.

Class B Fires—fires in flammable liquids, greases, etc., where a blanketing effect is essential.

Class C Fires—fires in electrical equipment, where the use of a "nonconducting" extinguishing agent is of first importance.

PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Rusted Gas Pipe Restored to Serviceability With Mechanical Tube-Cleaning Equipment

Restoring to service 12,000 ft of 1¼-inch rusted gas pipe may sound like a long, expensive undertaking. But by using air-driven mechanical equipment developed by Thomas C. Wilson, Inc., the Philadelphia (Pa.) Gas Works was able to make each of the 22 to 24-ft pipe lengths involved serviceable in four minutes at a cost of

about 2 cents per foot, including labor. Moreover, the operation was completed on the spot, without having to move any of the stored pipe.

This salvage operation, the answer to a problem familiar wherever large stocks of pipe are stored outside, was accomplished by use of both expanding brush heads and cutter heads. Brush heads, shown in insert, removed soft, powdery deposits even where surface deformities were present in the pipe. Cutter heads, shown entering pipe, consisting of threaded cone cutters mounted on standard universal joints, removed all degrees of scale.

Cincinnati Hospital Eliminates Scaldings With Thermostatic Water Control

Cincinnati's 100-bed Convalescent Hospital for Children, built in 1930, has a single-temperature hot water system. Water at 180 deg F is provided for kitchen, laundry, and bathing use. A separate low-temperature system for bathing use only would be too costly to install.

Some of the older children, who are recovering from all kinds of crippling diseases, use the bathtubs. Because they have no feeling in their lower limbs, they are unable to tell if they are using scalding water and could be badly burned, reports Mrs. Henrietta A. Spille, administrator.

To prevent accidents, the hospital installed two Type H Hydroguards, made by Powers Regulator Co., of Skokie, Ill. Each control serves two bathtubs. The controls are mounted on the water lines on the floor below the bathrooms, and are regulated only by the hospital engineer. Hot and cold water are blended in the controls and delivered to tubs at a maximum temperature of 110 deg. A nurse or patient can make the water cooler by turning on tub's conventional cold water valve, but it is impossible for hotter water to enter the tub.

Heating Problems of Temporary Schools Solved with Electric Baseboard

Suburban Seattle, Wash., has found a way to beat the schoolroom shortage, a problem faced by many communities. The solution is the use of one-room portable schools that can be jacked up and put on flatbed trucks when moving time comes.

One of the most important considerations for the portable buildings was the selection of a heating method.

The method chosen had to be easy to install and simple to disconnect. After all possibilities were investigated, Westinghouse baseboard electric heating was selected. Electric wiring is necessary anyway for lighting the classrooms, and the same service is used also for heat.

Each portable classroom—30 by 30 ft, with one wall of glass—is comfortably heated with 13 kilowatts of baseboard electric heating. The units work fast and safely, and the teacher has complete control of the classroom temperature through the use of thermostats.

Ewing Electric of Edmonds, Wash., installed the electric heating in the portable classrooms for grade and junior high schools in the Lake Washington School District, and Chapman Electric of Renton, Wash., installed the heating units in other portable schools.

Weatherproofing Air Conditioning

In the article on weatherproofing outside edges of recessed air conditioning units which appeared in this department last month (ACH&V., Sept. '58, p. 120) describing an installation in the River House, New York, the wording was somewhat confusing in crediting the contractor. The contractor credited handled the weatherproofing, not the air conditioning; the latter work was done by Standard Refrigerators, Inc.

NEWS OF THE MONTH

POWER SHOW

to feature special thermal liquids, high-pressure specialties, automatic switching, power equipment.

New techniques in heat control will be featured among the many advanced designs at the 23rd National Exposition of Power and Mechanical Engineering in the New York Colisium, December 1 to 5. The Exposition will be held under the auspices of The American Society of Mechanical Engineers.

Heat exchange equipment has become one of the most fertile fields for invention in recent years. This year's exposition will feature their latest advances. Noteworthy have been the applications of thermal liquids which are capable of absorbing heat without developing high pressures, even at relatively high temperatures. One exhibitor in this field has developed equipment for such applications as plastics and rubber, oils and fats, drugs and pharmaceuticals, paints and varnishes, and snow melting.

A newly designed high pressure steam gage, new explosion proof illuminators and jet pumps for fueling and defueling missiles will be incorporated in one display. Plastic solenoid valves for handling corrosive liquids will be another innovation.

• **SIMULATED WATER**—A number of displays will reflect the latest designs for level gages and specialized instrument valving. There will be a boiler water level indicator which avoids the use of glass. Replacing the conventional water column is an indicator of like appearance in which the water-steam line is shown by a simulated water level that is positioned magnetically. Another exhibitor has developed a miniature water level indicator, as well as a pressure differential unit for remote indication.

Uninterrupted power supply in public auditoriums and other places is often required by law, while many industrial operations would be heavily damaged were not emergency current available in the event of power line failure. Several exhibits will offer solutions for this problem. One line of automatic transfer switching equipment cuts in an emergency power circuit when the main source fails, its distinguishing feature being a mechanical holdout. This type of lockout is said to avoid the a-c hum of switches held on line electrically.

Many displays will present effective solutions for operational problems common to most plants. There will be high- and low-pressure oil burners, parts and accessories, solvents that are said to convert sludge into combustible material, as well as soot-burning chemicals.

The principal focus of the Exposition will be on the production and distribution of power in industrial establishments of every description. Many of the exhibits concern the generation and distribution of energy in heat, electricity, gases, compressed air and liquids, as well as motion.

Admission will be by invitation and registration only, exclusive of the general public. The management will be by the International Exposition Co. with permanent headquarters at 480 Lexington Ave., New York 17, N. Y. E. K. Stevens is the exposition manager.

FORCED OBSOLESCENCE

abandoned by air conditioning manufacturer, pledging to change models only with design advances.

Unitary Equipment Div., Carrier Corp., Syracuse, N.Y., announced that it will no longer change models each year just for the sake of change or on a calender cycle. New models will be on the market, the company states, only when there are significant advances in performance and design.

The firm, in taking the stand, states that the new policy must necessarily become effective over a period of time and cannot become completely applicable to all 1959 models, but that long range, it will not force obsolescence merely because of a different knob, a change in color, or the location of a control. It sees a distinct marketing advantages in the shift.

INDUSTRY ENGINEERS

Attend technical sessions in Moscow, Prague, London. Refrigeration machinery, plants, standards covered.

Frederick J. Reed, chief engineer, Air-Conditioning and Refrigeration Institute, and Henry G. Strong, executive secretary, Refrigeration Industry Safety Advisory Committee, attended international engineering meetings in Europe in September on subjects of interest to the refrigeration and air-conditioning industry.

According to plans announced earlier, Mr. Strong represented the refrigeration industry of the U. S. at sessions of two "commissions" of the Technical Board of the International Institute of Refrigeration, held in Moscow, U.S.S.R., and Prague, Czechoslovakia, and served as a member of the American Standards Association delegation at a meeting in London of Technical Committee 86 (Refrigeration) of the International Organization for Standardization (ISO).

Mr. Reed, a member of the Standards Committee of the American Society of Refrigerating Engineers, and its former chairman, headed the ASA delegation at the London meetings. Other members of the delegation, in addition to Mr. Reed and Mr. Strong, were Paul R. Achenbach, U. S. Bureau of Standards; B. R. Jennings, director of research, American Society of Heating and Air-Conditioning Engineers; Dr. R. C. Jordan, professor of mechanical engineering, University of Minnesota; Dr. C. F. Kayan, professor of mechanical engineering, Columbia University; E. M. Heap, joint Manager, York-Shipley, Ltd., London, and Philipp Goldman, general manager, Carrier A. G., Zurich, Switzerland.

• **STANDARDS DISCUSSED**—Scope of the London sessions was designated as "coordination of standards in the field of refrigerating equipment as used in refrigeration and air-conditioning," with areas of particular interest to the U. S. delegation defined as coordination of definitions and terminology, as well as safety and testing standards. In Moscow, Commission 3 of the Technical Board of IIR

discussed design, construction, and operation of refrigeration machinery and air-conditioning plants; and Commission 7, meeting in Prague, considered refrigerated transport by land and air.

Other Americans who made up the delegation to the Moscow and Prague meetings included Dr. W. T. Pentzer, chief of the Biological Services Branch, Agriculture Marketing Service, U. S. Department of Agriculture; John Kelley, manager of fruit transportation, Fruit Dispatch Co., New York City; Harland Nissen, vice-president and general manager, Terminal Refrigeration Co., Los Angeles, Calif., Dr. Kayan, and Dr. Jordan.

CENTRAL PLANT

for Los Angeles Civic Center supplies steam for both heating and cooling. Largest west of Mississippi.

Los Angeles County's new $3.5 million Central Heating and Refrigeration Plant, together with its 1500-ft. network of utility tunnels costing an additional million dollars, boasts the distinction of being the largest multiple-building feeder-type distribution system west of the Mississippi. It will provide complete heating and air conditioning service for all county buildings in the Civic Center.

Built of reinforced concrete and structural steel, the new plant contains 36,000 sq ft of floor space. It is topped by a cooling tower concealed by vertically louvered walls. Windowless, the building gains its ventilation from horizontal aluminum louvers.

The plant's five gas-oil fired boilers produce 160,000 lb steam per hr. In winter, steam provides heat. In summer, steam powers four centrifugal compressors with a refrigeration capacity of 4400 tons. This utilization of steam allows the boilers to operate at maximum efficiency at all seasons of the year.

• **UTILITY TUNNELS**—Fifteen hundred feet of reinforced concrete utility tunnels, 15 to 20 ft underground, connect the facility with the buildings it serves. The six distribution lines include: Two steel, 20-inch diameter chilled water supply and return lines for air conditioning. Water will be distributed at 45 deg F, returned at 55 deg; two 8-inch steel supply and return steam lines carrying 275 lb steam for heating; one 4-inch copper cold water line distributing softened, domestic cold water; and one 4-inch steel condensate line returning condensate to plant's de-aerating feedwater heaters.

The plant's near-automation engineering necessitates a staff of only six operators per shift. A soundproof, air conditioned control room is located on the main boiler room floor. Over a 20-year period, this centralized heating and refrigeration system is estimated to save $2,972,000 in county heating costs, and $1,603,000 in air conditioning expenses. M. A. Nishkian and Company, consulting engineers, Long Beach, designed and engineered the building and plant. Construction was by Haas-Haynie-Frandsen, Inc., Beverly Hills. Installation of equipment was done by Scott Company of Southern California, North Hollywood.

NEW RESEARCH HOUSE

will test steam and hot water heating and air conditioning systems. Large glass areas planned.

A $40,000 research house to be built at the University of Illinois by the Institute of Boiler and Radiator Manufacturers will be the second house built at Illinois by IBR for steam and hot water heating and air conditioning research under actual home conditions. The first, built 18 years ago, will be sold.

The new tri-level research house will have 8 rooms, 2½ baths, and 1,800 sq ft of usable space. In keeping with modern homes, it will have large glass areas. Hot water radiant baseboard heating, which was given its first test in the old house, will be used in the new one, along with a 3-zone chilled water fan-coil cooling system. Walks and drives will have snow-melting coils cast into them.

Three hundred thermocouples will be built into and installed in the house's structure, heating and cooling systems, and rooms. First research will deal with comfort problems of the popular split-level home, use of large glass areas, and zone control. Like many other new homes, this will be located in an open area without shade or wind-breaking trees.

The house will have three bedrooms, kitchen, dining room, living room, den, recreation room, and double garage. Removable plywood walls will provide easy access to pipes and wires. Lower level of the house will be of brick, and upper level vertical siding. The house will be completely furnished and occupied by research workers on the IBR project. It is to be finished by the end of the year.

RECORD HEIGHT

of diffusers is feature of church's new conditioning system. Old ducts for natural circulation utilized.

Highest outlets in the United States for the conditioned air of an air conditioning system—100 ft above the floor—are a feature of an installation completed for Riverside Church, New York City. The installation is part of a modernization program and an eight-story addition to the church.

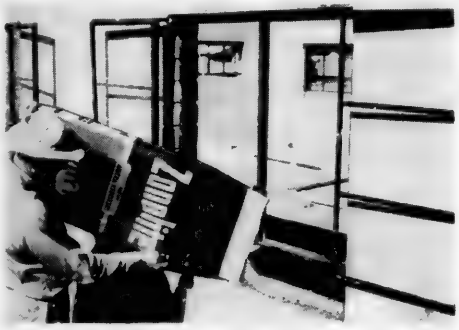
(Concluded on page 152)

NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid postcard appearing on the last page for securing additional information about new equipment and materials described in this department.

Wall Cavity Insulation

Introduction of a water-repellent insulating material for block and cavity wall construction is announced by Zonolite Co., Chicago, Ill. The product is a free-flowing mineral, water-repellent vermiculite. Reductions up to



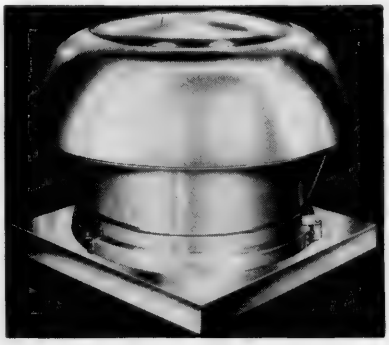
50% in heat transfer through masonry walls are said to have been accomplished when cores are filled with the material. Field test reports have indicated that substantial reduction in heating and cooling costs can be realized through use of the water-repellent material, with resultant savings in size of air conditioning and heating units.

More information? Circle Item 1, postcard, last page.

Extends Roof Exhauster Line

Type Hi-D, Series HCB (centrifugal wheel) and HAB (axial blade), belt-drive roof exhausters are announced by Jenn Air Products Co., Inc., Indianapolis, Ind., as additions to its power roof and wall exhauster line.

High air discharge with low-contour appearance of exhausters is achieved, the company states, by locating wheel or blade in the top of the all-aluminum housing.



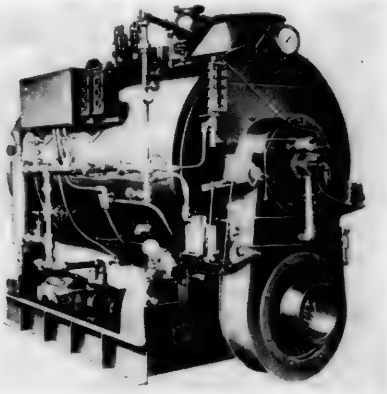
Other design features include: totally enclosed, full ball bearing motors, permanently sealed, pre-lubricated ball bearing tubular drive assembly, heavy gage stainless steel bird guards, adjustable motor pulley for speed variation, specially designed hinge on housing for easy opening and ready access to damper and drive, and positive locking mechanism when unit is in closed position.

Series HCB is available in 46 models with capacities from 1,620 to 21,400 cfm. Series HAB is available in 24 models with capacities from 4,130 to 28,650 cfm.

More information? Circle Item 2, postcard, last page.

Marine Steam Generator

A dry land adaptation of the company's marine steam generator, making it possible to obtain 5000 lb steam per hr from an overall floor area of 8 by 7 ft, has been developed by Cyclotherm Div., National-U.S. Radiator Corp., Oswego, N.Y.



Only 7 ft high, the boiler is designed to modulate over an extremely wide range with an exceptionally high efficiency, the company reports. It is completely electronically controlled.

An oil pump set assembly is factory-installed under the unit to save space and cut down installation cost. Water treatment tanks are mounted on the side of the boiler shell and piped to the feedwater pump system. By-pass piping permits manually controlled water circulation.

More information? Circle Item 3, postcard, last page.

Air Conditioning Limit Controls

Designated Series 210, these non-adjustable limit controls, manufactured by Penn Controls, Inc., Goshen, Ind., are specially designed for packaged residential and commercial air conditioning. They are suitable for use on R-12 or R-22, and water or air-cooled units.

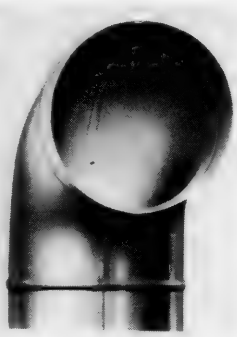
Compact, the control is suited for panel mounting or mounting in a limited space. Power element assures accurate, repeat performance, and provides for overrun pressures to 600 psig, the company reports.

The contact unit, in either SPST or SPDT action, is totally enclosed. Models are provided for low, high, or dual pressure, and may be supplied for automatic or manual recycle.

More information? Circle Item 4, postcard, last page.

Two-Piece 90-Degree Elbows

United Sheet Metal Co., Inc., Columbus, Ohio, announces its new line of die-stamped, two-piece, Laminair-Flo 90-degree elbows, said by the company to reduce friction loss and static pressure in high velocity air movement systems to a remarkable degree. Two die-stamped sections of 20-gage galvanized steel are welded together with two longitudinal seams to form the elbows, produced in uniform - size diameters from 3 through 8 inches.



The company's elbows are expected to replace hand fabricated four and five-piece segment elbows. The die-stamping process enables the two-piece elbows to be produced on a production line basis.

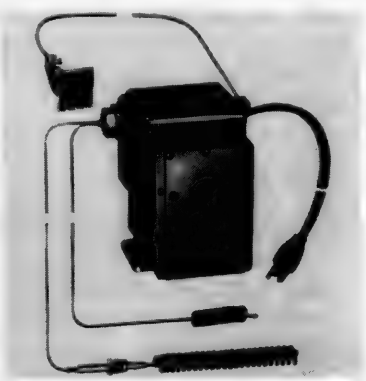
Tests on the reduction in turbulence and the resulting reduced friction loss have been conducted at a prominent Midwestern university for the manufacturer, and friction loss of the two-piece elbow was found to be nearly one-third less than that of five-piece elbows tested.

More information? Circle Item 5, postcard, last page.

Unit Ventilator Control

An all-electric package control system for face and by-pass type hydraulic unit ventilators, called the Dual Element Controller, is offered by Barber-Colman Co., Rockford, Ill. The package consists of a motor operator for damper control actuated by its own self-contained dual temperature sensing elements.

Controller combines the function of thermostat and controller in a single prewired package. It is inherently



positive positioning, and its high torque rating is said to assure accurate positioning of the unit ventilator damper mechanism at all times. The proportioning spring return motor operator features a rugged return spring which insures positive closing of the outdoor air damper whenever the unit ventilator is shut down for any reason, the company states.

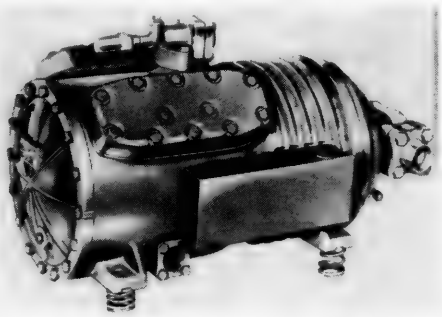
Because the controller is mounted within the unit ventilator housing, there is no need for a wall thermostat, thus substantially reducing equipment and installation costs. Its room air sensing element is mounted in a sampling chamber (available on all face and by-pass units) for precise control. This is said to be the aspirating principle used on the most difficult and exacting laboratory and industrial control jobs. As a result, control accuracy is superior to that of most wall thermostats, the location of which is ordinarily a compromise.

More information? Circle Item 6, postcard, last page.

Motor Compressors

The Brunner Co., subsidiary of Dunham-Bush, Inc., West Hartford, Conn., announces a new line of motor compressors.

Units are suction gas cooled, insuring greater durability and longer life to the motor windings. Bolted construction permits easy take-down for servicing, and



simple, speedy removal of valve plates for inspection. The units are of unusually compact design and light weight, the company reports; dynamic and static balancing assures quiet, reliable performance. They are available for use with refrigerant 22 in 2 to 15-hp models; with refrigerant 12 from 1½ to 7½ hp.

More information? Circle Item 7, postcard, last page.

Water Treatment Formulas

A major advance in water treatment technology, reported by The North American Mogul Products Co., Cleveland, Ohio, means more positive protection against scale deposits, faster removal of existing scale, plus maximum control and economy.

New in-plant water treatment formulas are for use in boilers (both high and low pressure), water supply systems, air conditioning and refrigeration systems, and industrial process cooling water. The formulas, while differing considerably to meet specific requirements, include chelating agents to establish a stable water.

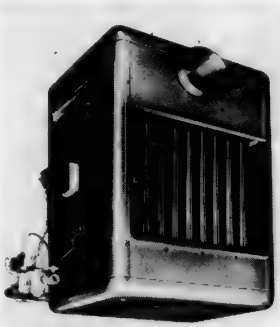
This group of formulas is furnished in highly concentrated liquid form for maximum ease of application. There is no problem of weighing or mixing individual ingredients, a fact that not only simplifies the actual feeding procedure, but also assures the operator that the dosages, as applied, will be uniform. These formulas are included in the same free service arrangements as the other products in the company's line.

More information? Circle Item 8, postcard, last page.

Duct-Type Unit Heaters

Duct-type gas-fired unit heaters, in a range of sizes for commercial and industrial heating, are available from American-Standard, American Blower Div., Detroit, Mich.

Compact and efficient, the duct-type unit heaters are recommended for automatic heating in all types of commercial and industrial forced-air duct distribution systems. They are practical when revamping central fan heating and ventilating systems, or for adding heat to air conditioning systems, the company states. They also serve well as booster heaters to provide extra heat in under-capacity central forced-air heating plants.



Units feature side-mounted gas controls, which are suitable for connection to either side. This design provides installation flexibility. Duct heaters are furnished with low-voltage control and a 24-volt transformer having a dual primary circuit suitable for either 115 or 230-volt connection. Size range includes 6 models rated from 50,000 to 165,000 Btu per hr input, adding to previously established 205,000 and 230,000 Btu per hr input sizes.

More information? Circle Item 9, postcard, last page.

Unit Measures, Transmits, Receives

Pressure, draft, differential, and level are directly measured, indicated, and transmitted by the Multi-Pointer gage unit manufactured by Bailey Meter Co., Cleveland, Ohio. This two-indicator unit is also furnished as a pneumatic receiver.

As a direct connected gage, each indicator section may contain a diaphragm element for draft, low pressure, or differential measurement; a bellows element for intermediate pressure or level measurement; or a bourdon tube for high pressure measurement. Standard ranges from 0-0.5 inches H_2O to 0-5000 psig are available.

As an indicating receiver each gage unit may contain two pneumatic receiving bellows. The gage unit then indicates any two variables capable of being transmitted pneumatically over standard SAMA signal ranges of 3-15 or 3-27 psig.

As an indicating transmitter, one section of the unit is occupied by the measuring element while the second section contains a pneumatic or an electric transmitter.

Any number of gage units may be mounted adjacent on the same panel to provide multiple indications. Seven-inch indicating scales are available in red, green, blue, yellow, and orange, as well as white for emphasizing desired variables.

More information? Circle Item 10, postcard, last page.

Expands Boiler Line

Edwards Engineering Corp., Pompton Plains, N. J., announces expansion of its boiler-burner line to include 4 new sizes of gas- and oil-fired boiler-burners.

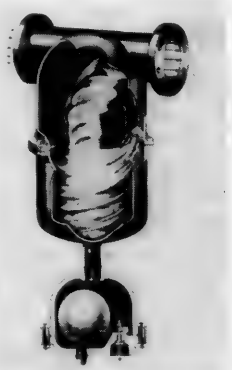
The complete line now includes: existing line—four models with 585 to 1200 sq ft ratings, and four new models from 1200 to 4,000 sq ft ratings, ranging in gross output rates from 100,000 to 600,000 Btu per hr.

All boilers have pre-packaged and pre-wired components and may be obtained with completely pre-assembled motorized zone control valves. Built-in automatic air elimination devices are included in all boilers.

More information? Circle Item 11, postcard, last page.

High Efficiency Separator

In keeping with its design policy of providing high efficiency, compact entrainment separators that can be supported by the line, Wright-Austin Co., Detroit, Mich., announces its improved Type T separator.



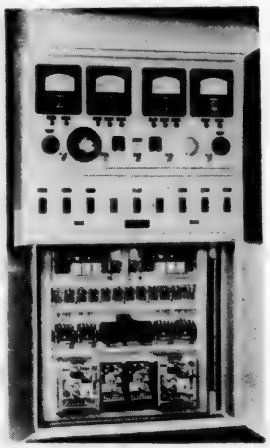
Designed for steam, air and gas applications, separator utilizes centrifugal force to separate moisture and oil entrained in the vapor flow. As shown in the illustration, the steam, air or gas is directed through an annular passage which increases its speed to produce a maximum of centrifugal force. The entrained matter which now clings to the outer wall drains to the bottom of the separator and then to the automatic trap. The entrance to the outlet chamber has been enlarged to provide for greatly reduced velocity at that point. This virtually eliminates re-entrainment problems associated with conventional separator designs, the company reports.

The force of flow and simple bottom collecting section make this a self-cleaning unit. The straight-through pipe connections permit easy and inexpensive installation. Series is available with screwed connections through 3 inches and 125 lb ASA flanges through 8-inch pipe sizes.

More information? Circle Item 12, postcard, last page.

Panel Control Centers

Free standing panel control centers, factory assembled, for power, heat and process applications are produced to customer specification by Cleveland Controls, Inc. (formerly Cleveland Fuel Equipment Co.) Cleveland, Ohio. These units, designed for maximum ease of assembly and service, are available in two expansible modular sizes: 36 inches wide by 84 inches high and 48 inches by 84 inches high.



Where the number or size of controls requires it, two or more panel control centers can be assembled into a fully integrated control unit with free access between assembled modules. Made of extra heavy gage steel, all panel control centers are finished in grey Hammerloid baked enamel. The full-hinged doors are secured by chrome plated key-lock handles. Front, side, and back exterior panels are easily removed for quick access to terminals. The integrated controls and accessories are assembled on a removable plate in the panel control center, whereas the instruments are mounted on removable face plates, producing a unified control package engineered to meet the customer's operational requirements. Metal canopies with fluorescent lighting are supplied as optional equipment.

More information? Circle Item 13, postcard, last page.

Water Tempering Valves

A line of water mixing or tempering valves intended for residential, commercial, and restaurant applications is announced by The Patrol Valve Co., Cleveland, Ohio.

Valves permit 180-deg F water to be used for automatic laundry washers, while at the same time water is available for other household uses. Other applications are

for home and restaurant dishwashing equipment, and commercial establishments, where both hot and very hot water is required to be available from one source, and in one water supply system.

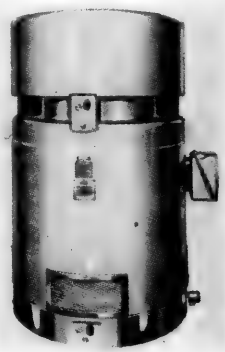
Model EV-A is adjustable. It is supplied in 70 to 130 or 120 to 165-deg ranges. Model EV-N is non-adjustable, and is supplied set at either 80 or 140-deg. Both offer a choice of either ½ or ¾-inch mixed water outlets, and the hot and cold inlets are fitted with dielectric insulating unions in a choice of sizes and in either sweat or N.P.T. connections.

Also announced is a mixing valve kit, Model EV-K, providing all of the necessary piping, elbows, crosses, as well as the company's pressure relief valve and Model EV-A mixing valve, ready to install on a domestic water heater.

More information? Circle Item 14, postcard, last page.

Vertical All-Weather Motor

The Louis Allis Co., Milwaukee, Wis., introduces a weather protected vertical motor intended for outdoor operation under all adverse weather conditions. The motor meets NEMA Type II Weather Protected specifications, and is manufactured in ratings from 250 to 2000 hp, in both hollow shaft and solid shaft construction.



Primary uses for the motor are in chemical and petroleum processing, irrigation, and municipal and other industrial applications in which vertical motors must operate without shelter or additional protection.

The motor is cooled by ventilating air taken from the surrounding atmosphere. To free this air of harmful moisture and dirt before it enters the heart of the motor, the air goes through three 90° changes in direction, is lifted vertically through screens, and expands in an air passage so that velocity is reduced to less than 600 fpm.

More information? Circle Item 15, postcard, last page.

Small Heavy-Oil Units

The 25J4 is a new edition of the Smith-Mills Series 250 cast iron water tube boiler and is furnished with a gun-type oil burner that will handle No. 4 and No. 5 fuel oils. The result is a unit, which according to its manufacturer, The H. B. Smith Co., Inc., Westfield, Mass., brings to small commercial buildings the operating economy and higher heat values of the heavy oils.

Lower first cost is achieved, the company states, by using a gun-type oil burner which preheats and then atomizes the oil before burning. Service required is about the same as an ordinary domestic size gun type burner. Units are available in net steam ratings of 1950, 2275, 2600, and 2925 sq ft, with water boilers of equivalent ratings. Built-in tankless heaters supply up to 12 gpm of domestic hot water.

More information? Circle Item 16, postcard, last page.

Automatic Hand Dryer

An efficient hand dryer for public restrooms is made possible by the use of a new electric motor developed by General Electric in cooperation with World Dryer Corp., Chicago, Ill. This motor induces a 20% increase in the hot air flow produced by the hand dryers. This greatly reduces the time required for hand drying.

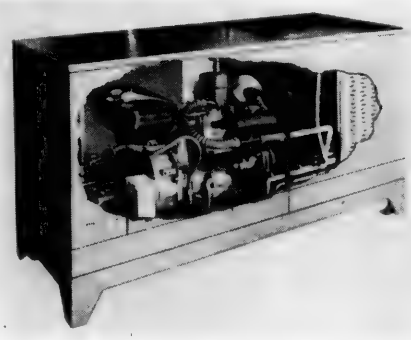
The air moving across the heating element is heated to 140 deg F at room temperature and an automatic circuit breaker prevents overheating. The dryer, actuated by a push button, operates for 30 seconds, then shuts off automatically.

Because of the sturdy design and construction of the dryer, it is completely protected against vandalism. Cover consists of a one-piece gray iron casting that is fitted with a chrome insulated push button, a chrome revolving nozzle, and an expanded metal air inlet grill. All the exposed portions of the iron casting are finished with an acid resistant porcelain enamel.

More information? Circle Item 17, postcard, last page.

Gas-Powered Air Conditioner

Manufactured by Comfort Products, Inc., Dallas, Tex., in 3- and 5-ton sizes for both residential and commercial uses, a gas-powered air conditioning unit, called Comfortemp, operates on the refrigerant compression system. A gas-driven, liquid-cooled internal combustion engine is used to drive a 4-cylinder, V-type standard compressor. The two are coupled by a dry-type clutch operating on a centrifugal principle, and engage only when engine has attained a predetermined speed. The action is modulated. Reduction in starting torque permits use of an engine of less horsepower and smaller physical size. An automatic lubricating device maintains oil at constant level in the crankcase, and servicing is needed only once each year.



Engine, compressor, and evaporative condenser are all contained in an acoustically-treated cabinet for outdoor installation. Condenser combines water spray and forced air to effect rapid heat transfer. Special water dispersal apparatus produces a heavy mist, as well as a washing action on the coil to minimize scaling and maintain high efficiency, the company reports.

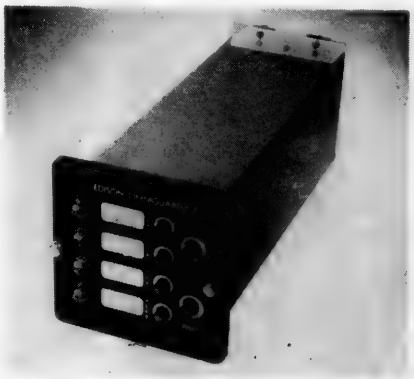
Standard thermostatic controls make the unit completely automatic in maintaining the desired temperature. Cooling output can be varied to provide correct balance for any requirement within the unit's cooling range. Installation is easy in any new or existing duct system, and it is claimed that the air conditioner can operate quietly for as little as one-third the cost of conventional electric units of comparable capacity.

More information? Circle Item 18, postcard, last page.

Temperature Monitor

A temperature monitoring system which eliminates electronic or electrochemical scanning and substitutes continuous monitoring of large groups of temperatures by independent circuits is developed by Thomas A. Edison Industries Instrument Div., McGraw-Edison Co., West Orange, N. J.

The system is basically a group of Wheatstone bridge circuits in which the company's resistance temperature detectors form one leg of each bridge. A current-sensitive



relay across each bridge operates when the bridge becomes unbalanced due to a high or low detector resistance. An auxiliary relay, operated by the sensitive relay locks, operates an alarm light on the face of the panel and energizes external alarm devices.

Four bridge circuits are combined in each Model 310 Omniguard monitor unit to monitor four temperatures. By using the *building block* principle, any number of plug-in monitor units can be grouped together with a single indicator to meet the requirements for either a small or a large installation. Momentary switches on the face of the monitor unit permit reading any temperature at any time. A switch tests the operation of each monitor unit and a reset switch returns the instrument to *normal* after test or an alarm condition has been experienced.

A line of resistance temperature detectors is available with the system for temperature ranges between minus 150 deg F and plus 1350 deg F.

More information? Circle Item 19, postcard, last page.

Spray Booth Filter

A bonded mat-faced filter, designed primarily for paint spray booths, is announced by Owens-Corning Fiberglas Corp., Toledo, Ohio.

Produced in pad form, with or without adhesive, the flexible filter media is said to offer high efficiency air cleaning at low cost where effective cleaning of air streams (not over 350 fpm) is desired.

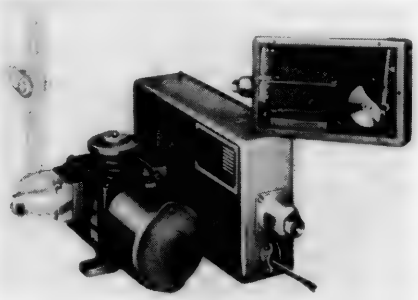
The new product is extremely effective in filtering even the few loose fibers resulting from vibration, shock, or turbulent air flow which might cause a hazard to an operation, the company states.

More information? Circle Item 20, postcard, last page.

Master Regulator

A master regulator, Model MR1000, is announced by The Optimum Control Corp., Cleveland, Ohio. It includes a special drive motor that can be stalled indefinitely and continuously reversed. This heavy-duty drive, coupled with a simple sensing mechanism, fits the unit for unusually long, trouble-free operation, according to the manufacturer.

Unit is designed to control pressure or temperature. It controls operating pressure of steam boilers, water temperature of heating boilers by adjusting fuel and air input; and controls gas or liquid pressures or temperatures in a process system, for instance. Regulator is electrically operated, said to be highly sensitive, with wide proportional band adjustment range. The unit shown has a torque range up to 204 inch-pounds and a pressure range up to 600 pounds. Others are available up to 12,000 inch-pounds torque.



Some of the features listed by the company are: complete electro-mechanical operation, simple electrical connections, dust-tight construction, integral cast-iron motor housing and gear case, heavy-duty control enclosure, and simple linkage arrangements.

More information? Circle Item 21, postcard, last page.

Versatile Coating-Sealer Line

A line of coatings and sealers is offered by Insul-Coustic Corp., Maspeth, N. Y., for protection, vapor barriers, color coding weatherproofing, and improved appearance. Products include:

IC 110, Sure Kote, a fire-retardant colored coating for color coding and finishing of insulated lines, vessels, and ducts. It is also applicable as an insulation liner for high-velocity air handling systems to prevent erosion of fibers;

IC 301, Weather-Sure, for weathercoating insulation on heated equipment. An economical mastic "breather" it is said to have high weather resistance and immunity to shrinkage cracks;

IC 320, 321, Vapo-Sure, is a trowel and brush applied asphalt vapor barrier mastic for vapor sealing and weather-coating insulations in low, high, and dual-temperature service;

IC 450, a high pressure sealer, seals joints and seams of high pressure ventilating ducts. Applied by brush to slip, flange, or lock joints; and

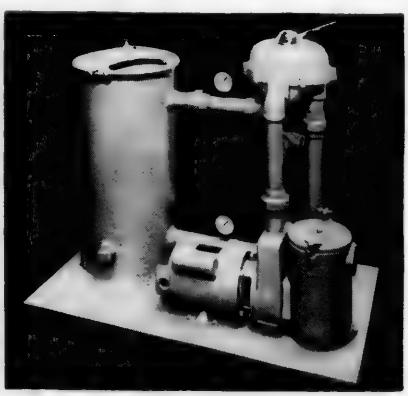
IC 503, a fire-retardant vapor barrier, provides a flexible but tough film over insulation on refrigerant piping and equipment. Samples are available.

More information? Circle Item 22, postcard, last page.

Swimming Pool Filter

A compact swimming pool filter, capable of re-circulating and purifying 45,000 gallons of water in approximately 16 hours, is announced by Purolator Products, Inc., Rahway, N. J.

The filter is engineered as two systems. One system, using Micronic filter elements, is designed for use with municipal water supply. The other employs a sand and gravel filter tank to filter and purify non-treated water from rivers, lakes, ponds, and other natural sources.



Both filter systems provide two-stage filtration and re-circulation. In both systems, the main filtering elements are preceded by over-size basket strainers to remove large harmful particles, such as sticks, grass, and stones, from the water system before finer filtration is accomplished. Most solid pool contaminant can be pumped from pool to waste without passing through the filter by hooking a standard swimming pool vacuum cleaner attachment to the connection provided in the filter system. Complete re-circulation and purification take place continually through the filter media.

As standard equipment, each filter system includes a Paragon Para Port 5-way valve, a non-corrosive valve with these five positions: (1) filter and vacuum to pool; (2) positive "close" position; (3) drain and vacuum to waste; (4) backwash; and (5) rinse.

More information? Circle Item 23, postcard, last page.

Unit Dust Collectors

Type M unit dust collectors are announced by The Kirk & Blum Mfg. Co., Cincinnati, Ohio. Three sizes are available, 450, 900 and 1800 cfm, the largest being 26 by 40 by 72½ inches. Compactness is achieved by careful placement of equipment within a rigid, durable enclosure.

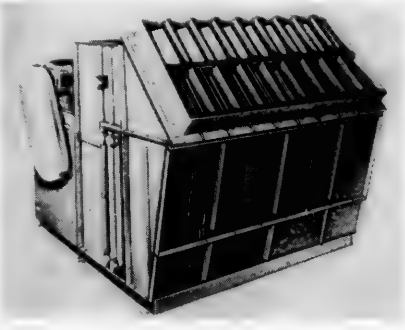
Dust-laden air is delivered to a small diameter, centrifugal precleaner where all but the finest particles are removed. The air then passes through 3-inch thick steel wool filter pads for final cleaning. Dust receptacles are gasketed, sliding drawers, secured with a hand wheel to insure a leak-proof seal. The after-cleaner, readily accessible through an expanded metal panel, usually requires cleaning not more than once in two weeks, depending on usage, the company states.

Where conditions will not permit the re-entry of cleaned air into the working area, filters are replaced with airtight closures and air vented to the outside. Exhaust stack connections are furnished at top of the unit. Both re-entry during winter months to conserve heat, as well as venting during summer for ventilation, are accomplished by equipping the unit with both exhaust stack and filters. The change is affected simply by turning a damper in the stack.

More information? Circle Item 24, postcard, last page.

Multi-zone Air Distribution

A new line of multi-zone air distributing units (Series 1600), for commercial buildings and air blending in multiple-zone applications, is announced by Sturtevant Div., Westinghouse Electric Corp., Hyde Park, Boston, Mass. In seven basic sizes for total capacities of 4000 to 34,000 cfm, units are made to handle up to 16 separate zones. Units are of the blow-through type with the



outlet divided to serve either cooled or heated air, or controlled mixtures of the two to each zone.

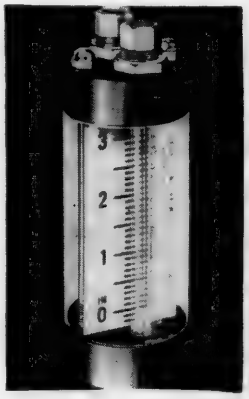
Fan wheels are designed with 60 deep, closely spaced, forward-curved fan blades to provide uniform air flow and assure quiet operation. Made of corrosion resistant, high-strength alloy steel, they are designed for surge-free operation.

The number of zones which can be served by a single unit varies with the unit size. All sets of dampers are interconnected with a single, continuous external connecting rod which can be cut in the field to suit the required number of zones. Individual zone control is then obtained by the use of separate modulating damper motors.

More information? Circle Item 25, postcard, last page.

Miniature Service Gage

Introduction of Model P-1 miniature service gage is announced by Ellison Draft Gage Co., Inc., Chicago, Ill. It is a round, vertical-tube model, portable and hand operated for measuring pressure, vacuum or differential readings. Available in ranges of 0 to 3 inches mercury and water, 0 to 40 inches of water using mercury, and 0 to 24 oz using mercury, it is described as a precision gage of modest cost, especially suited for service engineers kits, contractors, and engineering students. The gage is applicable to: dust collecting systems, where suction and discharge indications are required to initiate cleaning; air filters, where differential readings are needed to indicate replacement of filters; air conditioning systems, to evaluate blower suctions; boilers, to indicate draft in stack and windbox pressures; furnaces, to establish draft; and fans, to indicate positive or negative pressures.



Among the features of this gage are: heavy-wall glass indicating tube with straight uniform bore, protected by heavy transparent housing; ability to be replaced in the field without need for recalibration, drain plug screw on side of reservoir; nickel-plated steel fittings, and ease of disassembly for thorough cleaning.

More information? Circle Item 26, postcard, last page.

Offer Choice of 100 Bases

To meet the varying needs of oil heat specifications in all parts of the United States, Webster Electric Co., Racine, Wis., is offering ignition transformers with a choice of base plate styles as required. More than 100 different base styles are available.

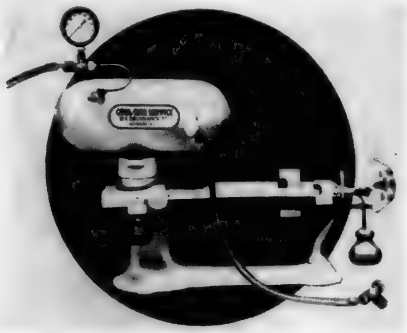
This decision, according to the company's oil heat division, eliminates the necessity of dealers maintaining an excessive inventory of transformers and bases. More than 200 varieties of oil burners can now be serviced with company's transformers and bases.

More information? Circle Item 27, postcard, last page.

Scale Weighs Refrigerants

Designed for dealers and servicemen installing or servicing air-conditioning and refrigeration systems is the Exact Charge Scale, introduced by Cool-Rite Service, Newark, N. J.

Called a new concept in introducing refrigerants into cooling systems, the device utilizes a delicately balanced scale to weigh, instead of measure, both liquid and vapor



refrigerants to within one-eighth-ounce accuracy. The necessity for calibrating a glass or checking frostback is eliminated, the company states. There are no electrical connections, and the scale is unaffected by temperature or pressure.

Lightweight, for easy shop or field use, the operator merely hooks the scale into the cooling system, sets the beam for the desired weight, and is assured of a completely accurate charge within a few seconds. Because the refrigerant is introduced directly from the scale into the cooling unit, there is no loss of refrigerant during the charging operation.

More information? Circle Item 28, postcard, last page.

Water and Liquid Circulator

Smaller size, lighter weight and lower cost are offered in a fractional horsepower water and liquid circulator manufactured by The Fostoria Pressed Steel Corp., Fostoria, Ohio. Designated Model 420-D in the company's line of seal-less pumps, the circulating unit is engineered

to handle water and non-abrasive fluids in both domestic and industrial applications.

Corrosion-resistant bronze and stainless steel construction is used in all wetted metal pump parts. With one-inch threaded intake and discharge connection, unit handles line pressures up to 150 psi, and fluid temperatures up to 230 deg F.

Motor and pump are contained in a sealed unit. Pump can be installed in any position, quickly replaced or serviced with an ordinary screwdriver. With a magnetic force to drive the pump impeller, the unit requires no starting device and has no bearings to lubricate, the company states.

More information? Circle Item 29, postcard, last page.

Drawing Filing System

Hamilton Manufacturing Co., Two Rivers, Wis., announces acquisition of exclusive sales rights to the Pack Interlock filing system, including the complete line of roll drawing files and all accessory equipment.

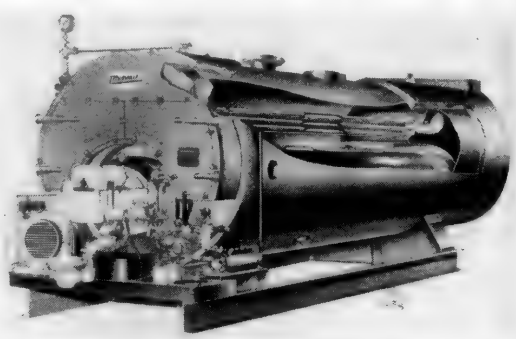
Now known as the Hamilton Pack Interlock filing system, it offers a systematic and economical method of filing valuable engineering roll tracings, project drawings and groups of inactive and semi-active documents. Benefits include simplified classification, maximum protection, and greater filing capacity due to use of normally dead storage space.

System consists of individual 2½-inch-square containers, easily dovetailed together to form any size or shape stack required. The inner tubular receptacles accommodate drawings up to 2¼ inches in diameter and are available in six lengths ranging from 22 to 54 inches.

More information? Circle Item 30, postcard, last page.

Three-Pass Scotch Boiler

A 3-pass scotch marine boiler, said to provide very high efficiency with improved operating economy, is announced by Titusville Iron Works, Titusville, Pa. A rear combustion chamber of water-cooled design, for which



a patent is pending, eliminates refractory in the rear combustion chamber and assures that hot gases are in contact with water-cooled, steel walls, utilizing to the maximum the useful heat of the gases, the company states.

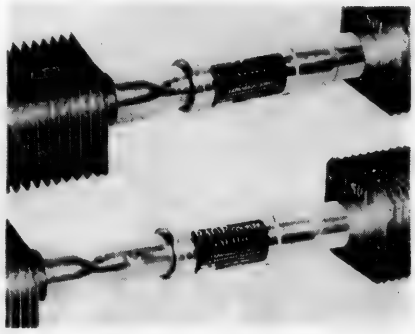
Unit is manufactured in low pressure S3H series and high pressure S3P series in sizes from 1725 lb per hr of steam to 31,050 lb per hr of steam, said to be the largest fire-tube package boiler manufactured.

More information? Circle Item 31, postcard, last page.

Baseboard Expansion Coupler

For baseboard hot water heating systems, there is a new type of expansion joint called the Base Slide Expansion Coupler. Manufactured by American Tube Products, West Warwick, R. I., and designed to eliminate the problems of expansion and contraction noises, stresses and strains, this coupler installs between the lengths of radiation, as shown, or on the supply piping.

A construction feature called "piston slide design" is claimed to provide three times more expansion movement



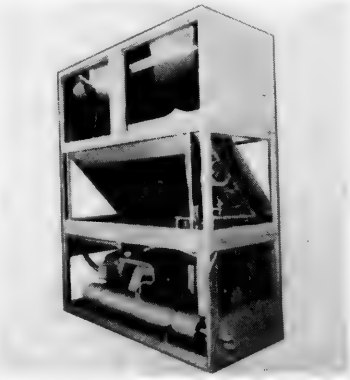
than common bellows type expansion joints, so that fewer joints are required. The coupler will accommodate the expansion and contraction movement of 100 lineal feet of baseboard radiation or copper tubing.

Further advantages claimed for the piston slide design of the coupler include no metallic bellows to wear, work harden, crack or break, and that coupler may be fully rotated in either direction which greatly eases the installation of radiation or copper tubing. Coupler, made of heavy copper tubing, is available in five sizes from ¾ to 2 inches.

More information? Circle Item 32, postcard, last page.

New Company Offers Conditioners

A package winter-summer air conditioner for commercial and industrial use is introduced by the newly-formed Dialatemp Corp., St. Louis, Mo. Known as the Dialaire, the unit is especially applicable to zone conditioning of multi-story buildings, factories, institutions, retail stores, shopping centers and similar applications.



Unit is available in three models and nine sizes from 15 to 100 tons capacity. It is a self-contained package, with all necessary piping, wiring and controls, and conforms to virtually all municipal codes. It is easy to install, and occupies a minimum of floor space, the company states.

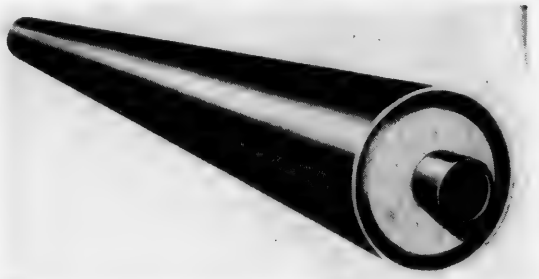
Compressor is custom-built to manufacturer's specifications. For winter air conditioning, two types of heating coils are offered: conventional hot water coil or a non-stratifying steam coil.

More information? Circle Item 33, postcard, last page.

Prefabricated Piping System

Addition of smooth wall piping systems to its present lines is announced by Portage Insulated Pipe Co., Barberton, Ohio.

The systems are for both underground and overhead distribution of steam, hot water, oil, other viscous fluids, process liquids, and refrigeration lines. The complete



system, including accessories and fittings, is factory prefabricated and shipped direct to the job site. Units can easily and quickly be installed with a minimum of field work. With this type of system the contractor and user can be assured of a pre-determined system cost. Units are available for both single and multiple insulated pipe systems.

Literature covering specifications, accessories, and field installation is available.

More information? Circle Item 34, postcard, last page.

Low-Temperature Insulation

A self-extinguishing, foamed plastic insulation for low temperature equipment and various building applications is developed by Armstrong Cork Co., Lancaster, Pa. Called SE Armalite, the material has essentially the same physical properties as the company's polystyrene foam insulation, plain Armalite. Both products have a low density of 1.25 lb per cu ft, yet both are exceptionally strong and will not swell, warp, or buckle upon exposure to low temperature, the manufacturer states.

The new material, however, contains a self-extinguishing ingredient which is "locked" into the polystyrene early in the manufacturing process to assure a more thorough, uniform distribution without lessening the overall thermal efficiency of the product. With a k factor of 0.24 at 60 deg F mean temperature, insulation boards are made in standard sizes ranging in length from 3 to 15 ft, and in widths from 12 to 36 inches. Standard thicknesses are 1, 1½, 2, 3, 4, and 6 inches. Special sizes and factory fabricated parts are also available.

More information? Circle Item 35, postcard, last page.

Stainless Steel Drinking Fountains

An attractively-designed line of drinking fountains, in stainless steel, is introduced by Just Manufacturing Co., Franklin Park, Ill.

Suited for use in schools, hospitals, and commercial and

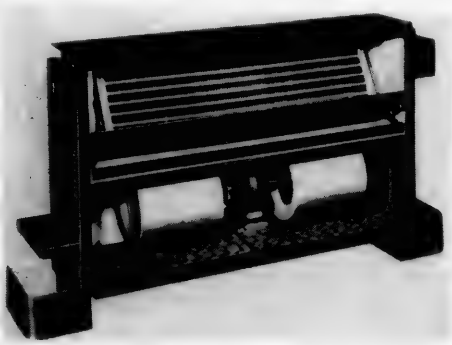
institutional buildings, the drinking fountains are available in a wide range of styles and sizes.

All fountains feature 18 gage stainless steel, seamless welded construction body and receptor with a No. 4 finish on all exposed surfaces. Access and closure panels are fabricated of 24 gage stainless steel with a die-embossed pattern of bright contrast finish. Exposed trim is furnished in bright chrome finish. The line is available in semi-recessed, fully recessed, wall-hung, and cuspidor models.

More information? Circle Item 36, postcard, last page.

Fan-Coil Room Units

Called Diaflo, a line of individual room air conditioners is offered by American Blower Division of American-Standard, Detroit, Mich. A wide choice of installation arrangements is available. The fan-coil units are designed for summer cooling and winter heating of multi-room structures.



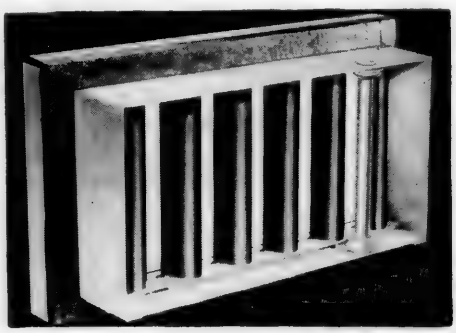
Vertical models may be used with standard top-discharge enclosures, free-standing front-discharge enclosures, or custom enclosures having either top or front discharge. Horizontal models for ceiling mounting are used with either standard or custom enclosures.

In four sizes: 200, 300, 400 and 600 cfm, units may be used with or without outside air for ventilation, or may be used with pre-conditioned primary air. Individual room temperature controls permit adjustment to suit occupant. Coils are removable and reversible at the job site should opposite hand connections be desired. Fan and motor assembly and coil are conveniently removable from the basic unit. One-inch thick filters, either throw-away or cleanable type, can be taken out of the unit without removing the casing. Complete access to coil, drain, and electrical connections is provided.

More information? Circle Item 37, postcard, last page.

High Velocity Air Valve

Model R high velocity air valve, composed of gang operated, Neoprene vane sections, is available from Barber-Colman Co., Rockford, Ill. It is said to provide simple, positive control of velocities and pressures and assure linear control of air volume. Designed for use in a



variety of applications, the valve can be used in single duct systems to control velocities and to balance the system, or in double-duct applications to mix hot and cold air and to control velocities.

Engineering data, dimensional, descriptive and application information are contained in a new catalog, F-8752.

More information? Circle Item 38, postcard, last page.

Dual-Range Thermometer

A dual-range thermometer with self-shielded core magnet meter movement is announced by Simpson Electric Co., Chicago, Ill. Model 389-3L Dual Range Therm-O-meter is designed for measuring temperatures of gas, liquid, or solids. Its low range extends from minus 50 to plus 100 deg F; the high range from 100 to 250 deg.

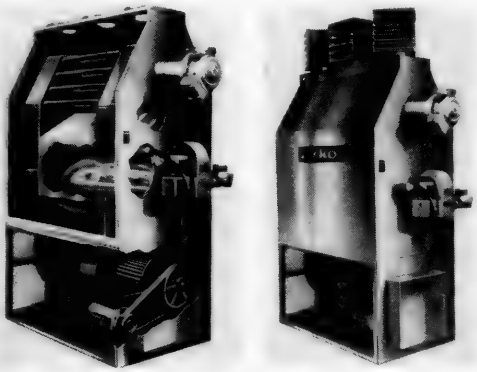
Three leads are accommodated simultaneously with separate readings through one selector switch on the front of the instrument. Readings are made in a matter of seconds, the company states, with overall accuracy of 3 deg in any position, and at near center scale, within 2 deg or better.

Recommended fields of application include: ice manufacturing, freezer storage, refrigeration, air conditioning, and heating systems. Using the three leads, temperature readings can be made in three different locations at the same time; i.e., in a refrigerator, one lead could be connected to the evaporator plate, another to the wall of the food compartment and the third in the center of the food compartment.

More information? Circle Item 39, postcard, last page.

Direct-Fired Heaters

A line of direct-fired heaters for factories, warehouses, churches, institutions, and commercial buildings, is introduced by Arkos Mfg. Co., Detroit, Mich. It features a stainless steel combustion chamber with four-point floating suspension to allow free movement during heating and cooling cycles. According to the company, the diamond shaped chamber is designed for optimum combination of maximum combustion volume with maximum scrubbing action.



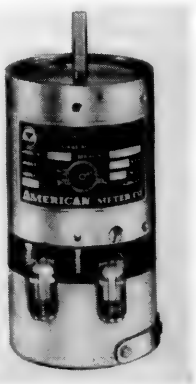
Extra heat transfer is gained through economizer tubes above the combustion chamber, swaged into headers to eliminate stresses and buckling. A panelled cleanout plate exposes the tubes for cleanout. Standard capacities range from 400,000 to 3,500,000 Btu with light and heavy oil burners, gas burners, or combination burners. Power burners are furnished with combustion air blower as an integral part of the burner for independent combustion air adjustment and separate induced draft setting.

Models are available for floor mounting, for horizontal mounting and for inverted, vertical mounting. All models can be optionally equipped with duct inlet and outlet connections, with separate blower compartments for by-pass systems.

More information? Circle Item 40, postcard, last page.

Gas Powered Instrument Drive

The Gasclok, a self-contained air or gas powered instrument drive and timing unit, is introduced by American Meter Co., Erie, Pa. It can be used as either original or replacement equipment in all makes and types of recording instruments, and it is said to deliver a constant power output of more than 20 times the torque supplied by conventional spring-wound clock mechanisms.



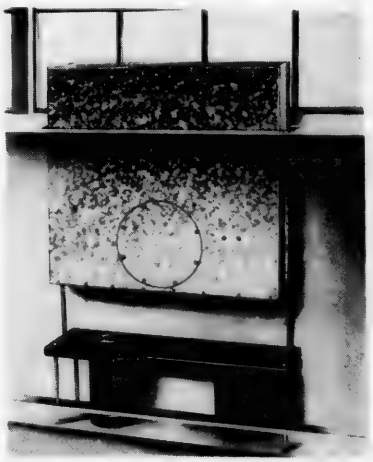
Field tested and designed for operation in remote installations, the drive can be used with instruments requiring chart records from one-hour to 30-day periods, including integrating orifice meters, strip chart recorders, gas lift meters, pressure recorders, telecounter units, and field program timers.

Unit is inherently explosion proof and internally sealed to prevent corrosion or clogging; all parts exposed to gas are made from aluminum or stainless steel. It has a gas or air consumption of 5 cfh at its normal operating pressure of 5 psi. Designed for mounting in any position, the timing escapement spring is rewound every five seconds to eliminate fluctuating torque, and the clock accuracy is not affected by wide fluctuations in supply pressure.

More information? Circle Item 41, postcard, last page.

Under-Window Valve Attenuator

Connor Engineering Corp., Danbury, Conn., announces its Under-Window model dual duct valve attenuator which features both quick installation and quick removal from the air conditioning system.



The unit, when installed, is completely enclosed in the wall. Unlike other valve attenuator designs, however, it is not directly attached to the high velocity duct work. Rather, it is clamped to a mounting plate by toggle bolts. Simply by loosening these bolts, the entire unit can be removed easily and quickly from the base plate through the top discharge grille opening, as illustrated.

A wide range of sizes assures proper selection of the unit that will give the precise air delivery, static pressure, and sound level essential for specific applications.

More information? Circle Item 42, postcard, last page.

Larger Condenser, Cooling Coils

A larger capacity air-cooled condenser and matching cooling coils have been introduced by Halstead & Mitchell, Pittsburgh, Pa., for residential and small commercial air conditioning installations.

The company now offers its Type ACR condensers and Type VR and Type HR enclosed cooling coils in 7½-ton capacities. They formerly were available only in 2, 3, and 5-ton sizes.

More information? Circle Item 43, postcard, last page.

Polyethylene Faucet

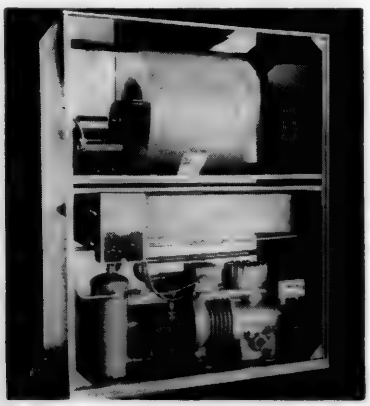
Development of a high temperature, high density, polyethylene faucet, designed for use in polyethylene tanks and other vessels, is announced by American Agile

Corp., Maple Hts., (Cleveland), Ohio. Faucet is ¾ inch in size and has been adapted as a practical solution to draining corrosive liquids from various containers.

More information? Circle Item 44, postcard, last page.

Air-Cooled Packaged Chillers

The addition of air-cooled packaged chillers to its line of cooling products is announced by Embassy Steel Products, Inc., Brooklyn, N. Y. Available in models from 3 through 15 hp, the chillers are completely air cooled, requiring no condenser water. Applications include cooling of water and liquids for industrial processing and air conditioning.



Chillers are compact, completely assembled units, charged and wired at the factory to reduce installation costs. They are fully cork insulated. Models from 3 through 7½ hp have one chiller; 10 and 15-hp models have two separate chillers. Either one or both may be used depending on the cooling application required.

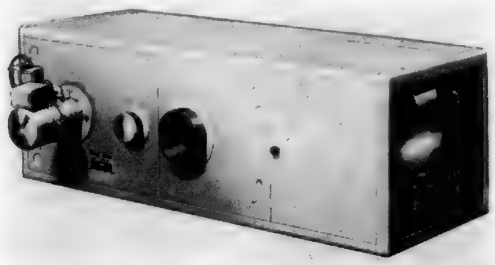
Condenser is large-surfaced copper tubing with aluminum fins for rapid heat transfer. Liquid receiver is of ample capacity to insure peak performance. It is equipped with a charging valve and test cock to check refrigerant level when unit is pumped down.

More information? Circle Item 45, postcard, last page.

Gas-Fired Furnace Line

Development of a line of Shafconaire gas-fired furnaces, designed for use in commercial and industrial buildings, is announced by OverHead Heaters, Inc., Detroit, Mich.

Offered in three basic models rated at 142,000, 182,000 and 252,000 Btu per hr output, the furnaces feature a special power burner which provides closer control of combustion gases through the heat exchanger, thus assuring greater operating efficiency and lower heating



cost, according to the manufacturer. In addition, the furnaces are designed to handle a large volume of warm air at high velocity and can readily be connected to duct work to obtain controlled distribution of heat where desired. They may also be quickly and easily adapted in the field for either right-hand or left-hand installation.

Said to be priced lower than any other type of gas heating equipment of equal capacity on the market today, furnaces are covered by all required approvals, and may be installed as close as two inches to combustible materials to provide maximum head-room. All models are furnished complete with controls, power burner, and blower—with or without filters as required.

More information? Circle Item 46, postcard, last page.

Redesigned Water Level Gage

Remote reading water level gages, made by The Reliance Gauge Column Co., Cleveland, Ohio, under the name Eye-Hye, have been redesigned, in higher pressure models, for wider vision. The image of the company's green indicating fluid, Vizzene, is carried out in front of the face plate by means of a protruding plastic reading medium, enabling boiler room attendants to read the water level at any angle, even 90 degrees from center, either side.

While the simple manometer principle of the gage operation remains unchanged, design and construction has been improved, company reports, including a new high-power illuminator. Literature describes models for pressures to 900, 1500, and 3000 psi.

More information? Circle Item 47, postcard, last page.

Refrigerant Control

Developed for refrigeration applications where a precise, limited float or displacement action is desired, the R-273 Magnetrol is available from Magnetrol, Inc., Chicago, Ill.

The model has a newly developed switch mechanism featuring positive switching action, obtained by as little as one-half inch of liquid level travel in some applications, it is said.

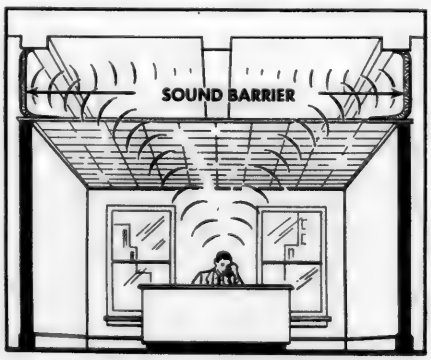
A 3½-inch diameter float, constructed of Type 304 stainless steel, provides twice the operating force obtainable in other types of controls, the company states. The float is so constructed that it cannot touch sides or bottom of the float chamber; therefore it cannot stick in any accumulations of oil, grease, or sticky sediment which might be caused by a leaky compressor.

More information? Circle Item 48, postcard, last page.

Ceiling Sound Barrier

A sound barrier, introduced to solve the problem of sound transmission through suspended acoustical ceilings, is announced by Acoustical Div., Elof Hansson, Inc., New York, N. Y. Installed as illustrated, it affords privacy of speech.

The need for such a barrier has become critical, the manufacturer asserts, because the average sound transmission loss through mechanically suspended acoustical ceilings is inadequate. The same quality or porosity which makes acoustical tiles good sound absorbers, also permits sound to pass through them.



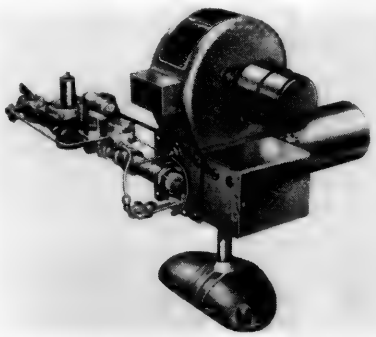
Movable and masonry partitions usually extend only o the height of the suspended ceiling, the manufacturer ates, resulting in lack of privacy of speech between djacent rooms partitioned off in this fashion. Barrier is intalled from the underside of the concrete arch or floor above, down to the top of the partition above the acoustical ceiling. The barrier is said to increase the sound transmission loss through the entire construction to 40 decibels, which is adequate for privacy of speech.

Consisting of a flexible incombustible asbestos, aluminum and mineral wool, barrier is a standard 36 inches in length, and is available in 24-, 36-, and 48-inch heights.

More information? Circle Item 49, postcard, last page.

Power Gas Burners

Lower price and increased capacity are reported to highlight the 1959 line of power gas burners manufactured by Hastings Air Control Inc., of Omaha, Neb.



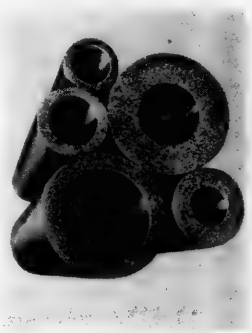
Five new models in the expanded line are rated from 70,000 to 700,000 Btu per hr. The burners are guaranteed by the manufacturer against backflash, pulsation, and pilot outage, even under adverse conditions.

Other features include primary air adjustment for quiet, vibration-free operation; Positrol air switch to delay opening of gas valve until blower comes up to speed; and plug-in type safety shut-off in case of pilot flame failure.

More information? Circle Item 50, postcard, last page.

Flexible Tubing for Insulation

Closed cellular rubber tubing, produced by Rubatex Div., Great American Industries, Inc., Bedford, Va., is now available in sizes to fit any piping insulation requirement, the company states.



Designed to provide positive insulation for all warm or cold fluid piping, this soft, flexible tubing provides an effective seal to keep temperatures constant while preventing condensation on heating or cooling tubes. The new tubing sizes are made possible through the company's recently developed extrusion process which produces virtually any linear shape.

Tubing is offered in wall thicknesses of 3/16, ¼, ⅜, ½ and ¾ inches with all standard diameters from ⅜ to 4⅛ inches. It can be ordered ready to slip directly onto piping or slit lengthwise to be sealed to piping with an adhesive.

More information? Circle Item 51, postcard, last page.

Power Roof Ventilators

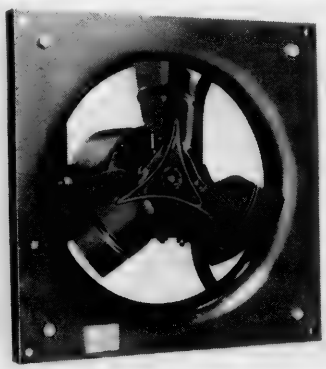
The addition of two larger sized power roof ventilators has increased exhaust capacity in the company's Type L-LSQ line to 21,000 cfm, and supply capacity in the Type L-SRQ line to 19,600 cfm, reports Ilg Electric Ventilating Co., Chicago, Ill.

Units, Sizes 423 and 483, are said to have scientific air-flow design which not only makes them highly efficient for ventilating large spaces, but extremely quiet and well suited for use in such places as schools and hospitals as well as industrial plants.

More information? Circle Item 52, postcard, last page.

Propeller-Type Fans

A line of special purpose propeller type air moving units, for cooling and ventilating electronic equipment cabinets or other applications where low pressure, high volume air is required, is announced by American-Standard, American Blower Division, Detroit, Mich.



The fans are available in a variety of configurations, sizes, and wheel designs to meet a broad range of commercial or military specifications. Typical of the new line is Model No. 89C15 air unit, illustrated. Fan inlet and motor supports in this model are made of die-formed steel; the fan wheel has aluminum blades. Finish is gloss black enamel to meet military specifications; other finishes can be furnished on request. Rated at 1/6 hp, it delivers 1300 cfm of air at zero static pressure and 1725 rpm.

More information? Circle Item 53, postcard, last page.

High Pressure Duct Sealer

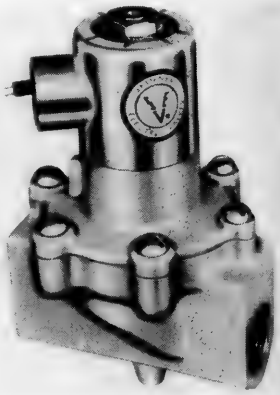
Goodloe E. Moore, Inc., of Danville, Ill., has recently developed a high pressure duct sealer known as Tuff-Bond No. 12, which has a synthetic rubber (butyl) base. Laboratory and field tests have proven it to be an efficient product and one that is easily spread with brush or used with a caulking gun.

The sealer skims over in two or three minutes, and dries overnight under normal conditions. Its adhesion to galvanized iron is excellent, the company reports, and its thermal limits are minus 30 deg F to plus 200 deg, with high resistance to gasoline, oil, and water.

More information? Circle Item 54, postcard, last page.

Two-Way Valves

Series L high-flow, two-way valves with ¾ and 1-inch diameter orifices are announced by Skinner Electric Valve Div., Skinner Chuck Co., New Britain, Conn. These valves complete an all-new line of two-way valves previously introduced in ⅜ and ½-inch sizes. They are designed to control such common media as air, oil, and water and are smaller, more compact and considerably lower in cost than the Series M2 valves they replace, the company states.

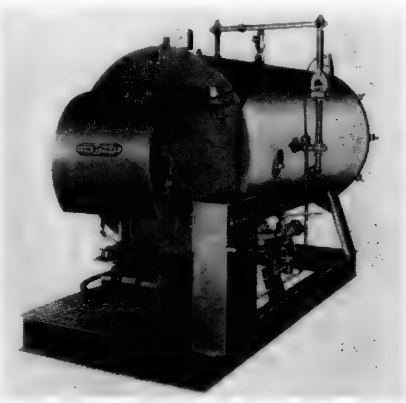


Valves operate on a pressure differential of 5 to 150 psi and are available in standard and explosion-proof construction, normally open or normally closed. They mount directly to a line in any position and can be serviced without removal. The forged naval brass body provides a dense metal structure. All internal metal parts are stainless steel.

More information? Circle Item 55, postcard, last page.

Packaged Hot Water Boilers

New automatic boilers designed exclusively for hot-water systems will deliver either continuous heat at varying rates of heat flow, or intermittent heat at a fixed rate of heat flow. Both requirements have created difficulties in converted boilers that were primarily designed for steam. The growing popularity of hot-water heating necessitates boilers specially designed for this type of heating system.



The SPW line, manufactured by York-Shipley, Inc., York, Pa., includes fourteen models in capacities from 30 to 500 hp, manufacturer's certified rating. Standard pressure is 30 psi; standard maximum temperature 250 deg F. Burners may be specified for light oil, heavy oil, gas or gas-oil combinations.

More information? Circle Item 56, postcard, last page.

Lavatory for Transients

The Ledgend lavatory, product of Kohler Co., Kohler, Wis., is recommended for hotel, motel, tourist court, and restaurant installation. It combines a dressing table and smartly styled lavatory in a single unit of easy-to-maintain vitreous china. Completely free of joints, the large

unobstructed slab allows generous storage space.

Lavatory is equipped with the company's All-Brass fittings, and can be furnished with three fittings, as illustrated, for hot, cold and ice water. Models are available with the dressing table on either side, and in white or seven colors. The flat design permits use of a large mirror directly above the lavatory.

More information? Circle Item 57, postcard, last page.

Gas Lighting Making Comeback

The gas light, distinctive symbol of a period in American living, is aglow again throughout many parts of the nation.

The Gaslite, trade name of the manufacturer, Arkla Air Conditioning Corp., Evansville, Ind., uses natural gas, butane, or propane for fuel. Distributed nationally by gas utility companies, these units may be used wherever outside illumination is wanted — on patios or porches, along sidewalks, steps or driveways, beside swimming pools. They are easily adaptable to posts, or fasten conveniently to sills with ready-made brackets.

Lights are picturesque as well as practical, and are available in three styles: Cabildo, illustrated; Flair, with wide canopy and frosted or plain glass; and Heritage, in traditional American design.

In addition to residential application, the gas lights have been installed on lawns of many large housing projects, motels, and restaurants; in front of a city hall and other downtown business buildings, and along the entire drive of a country club.

More information? Circle Item 58, postcard, last page.

Your ideas work better when you work with HONEYWELL

The following pages bring you the latest developments in automatic controls from Honeywell. They widen your choice of products, give you more to work with.

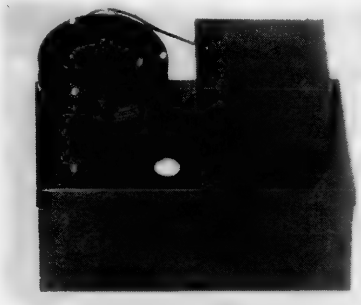
For complete information on these new control products and systems, call your nearest Honeywell sales office. Honeywell provides 112 offices throughout the country; each is staffed with capable control specialists to assist you in preparing proposals and writing specifications.

Look over these new products and systems. And, remember, they are backed by the kind of support only Honeywell can offer you.

FOR MORE TO WORK WITH... WORK WITH HONEYWELL

Automatic Condensate Units

A line of low cost automatic condensate units has been developed by Thomas A. Beckett Co., Dallas, Tex. In addition to use for removal of condensate or overflow from air conditioning systems, the units are suited for all appli-



cations where gravity drainage is found to be impossible or impractical.

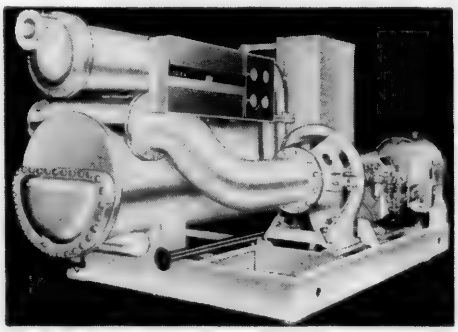
Condensate unit is manufactured in three sizes with 10, 20, and 40-ft lifts, and can be supplied for either 115 or 230-volt operation. The larger size model (CU-55, illustrated) will handle a range of capacities from 300 gph with 6-ft lift to 28 gph at 40-ft lift.

A motor designed for minimum heat transfer is used to drive the pump. Motor coils are double varnished and dipped for added protection. Safety controls include a separate float which will automatically shut off the air conditioning compressor in the event of pump failure.

More information? Circle Item 59, postcard, last page.

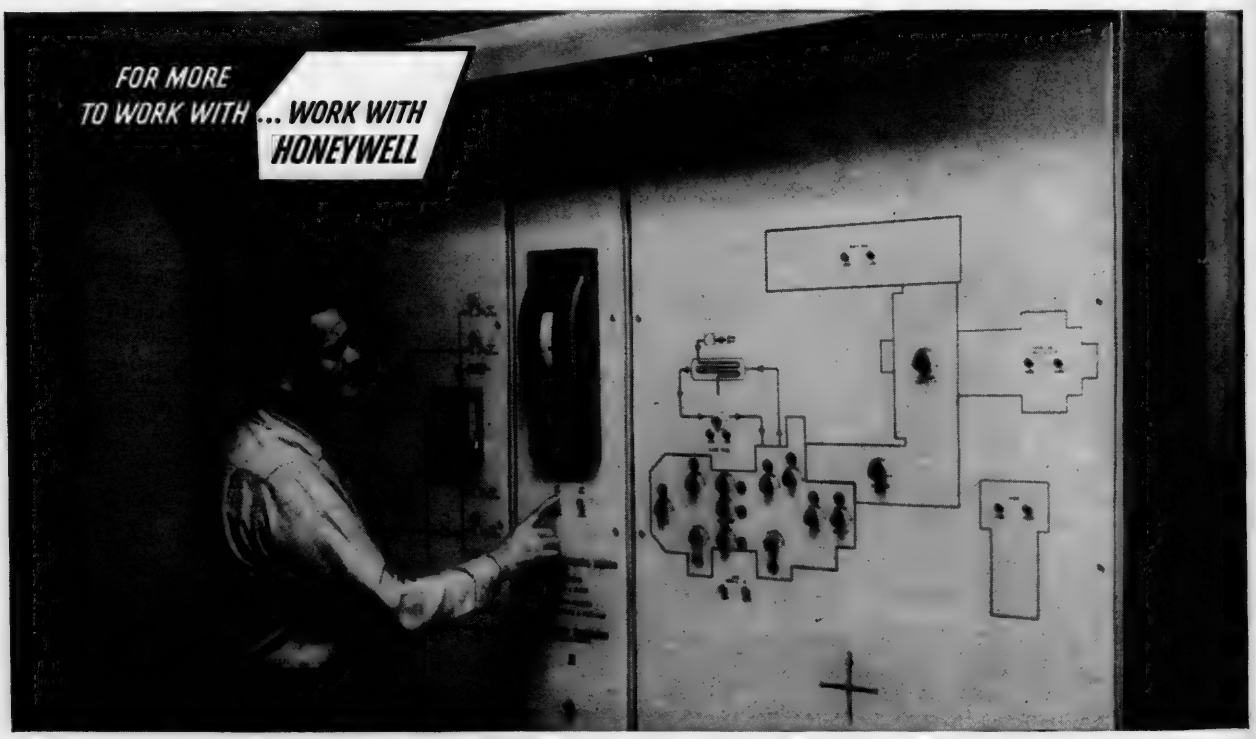
Packaged Water Chillers

Completely packaged centrifugal water chilling systems, called Turbopaks, are offered by York Corp., York, Pa., subsidiary of Borg-Warner Corporation. For water



cooling applications to 350 tons, the one-piece system is factory assembled to include all controls, motor starter, control piping, and wiring. The entire system is easily trucked and rigged.

More information? Circle Item 60, postcard, last page.



Honeywell Supervisory DataCenter in St. Mark's Episcopal Church, Shreveport, is located in the building engineer's office, provides one-man control for air conditioning of parish property including hall, chapel and school besides the church. Owners: St. Mark's Episcopal Parish; Architect: Annan and Gilmer; Consulting Engineers: Paul Rottmann & Associates.

Fuel Demand Meter

Announced by Johnson Degree Day Systems, Kalamazoo, Mich., is the Johnson Fuel Demand Meter. Device registers total accumulated effective degree days, effective degree days being defined by company as the net effect of temperature, sun, and wind upon fuel consumption.

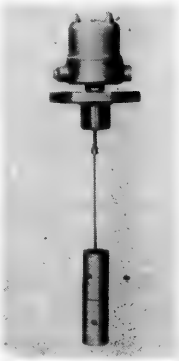
A weather-sensitive element fastened to the roof and

exposed to the weather connects by electrical cable to an inside unit located on wall or desk. An electrical supply cord plugs into 110 volt outlet. Standard instrument gages range from 65 deg F base to minus 35 deg. The meter has a reset mechanism so that total can be set to any accumulated reading. Model C-20-T meter registers total accumulated effective degree-days for a complete heating season. Readings need be made only on days when office is open; operator obtains immediate readings at start of each day.

More information? Circle Item 61, postcard, last page.

Liquid Level Controls

Precise control of liquid level is obtained with new type single-stage, narrow-differential liquid level controls, Models A-152-F and A-153-F, recently added to the line of Magnetrol, Inc., Chicago, Ill.



Small movement between make-break contacts provides high sensitivity to level change, the company announces.

A greater number of liquids can be controlled with the level controls. These include liquids with a specific gravity of 0.30 and higher, temperatures to 500 deg F, and pressures to 5000 psi.

Displacers are available in many materials, including Karbate, porcelain, and stainless steels. With stainless steel displacers, interface applications are also possible.

More information? Circle Item 62, postcard, last page.

Honeywell Supervisory DataCenter

increases efficiency, reduces air conditioning cost for any building—here, a church!

One of over 350* Honeywell Supervisory DataCenters sold throughout the country is illustrated on the opposite page. It provides supervision and control of the entire air conditioning system for St. Mark's Episcopal Church in Shreveport, Louisiana. One module of its panel shows the entire floor plan of the buildings with temperature check buttons and temperature adjustment knobs for eleven zones. Another module diagrams the entire hot and chilled water system, in color codes. A precision Tel-O-Set recording instrument located in the supply header flow diagram gives a continuous record of hot and chilled water supply to all units.

In this, as in all Supervisory DataCenter installations, the controls, instruments and central panel are manufactured, installed and guaranteed by Honeywell—a major central-control benefit only Honeywell can offer.

Working installations in all types and sizes of buildings across the country demonstrate clearly Honeywell's leadership in centralized air conditioning control. This experience is available to you at no obligation. A Honeywell specialist will be glad to work with you and your ideas from the original planning stage of any building. Just call your local Honeywell office for full details.

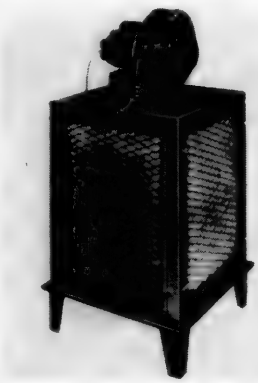
*List of installations, including those in your area, available on request.

Honeywell

First in Control

Mist Collector

The MC-412 mist collector, offered by Torit Mfg. Co., St. Paul, Minn., is designed to control mists from wet machining operations that can endanger employee health or create fire and safety hazards. Measuring 22 inches square, it can be floor-mounted on legs or mounted on walls or ceiling to conserve space. It is 47¼ inches high, including its top-mounted motor and blower.



Collector requires no high voltage electronic equipment, the company says, but filters mist and fog by passing the air through high-performance spun glass filters that can be easily and economically replaced. In normal operation, the filters will operate efficiently for many months, the company states.

Condensed coolant mist is collected in the bottom of the mist collector where it can be drained for re-use. The system can be connected directly to the machine coolant system for continuous flow.

More information? Circle Item 63, postcard, last page.

Gray Sheet Glass

Development of a gray sheet glass for building areas which require brightness control is announced by Pittsburgh Plate Glass Co., Pittsburgh, Pa. To be known as Pennvernon Graylight, the glass is designed specifically to meet the need of the architectural field for a glass to help control light environment. It will be manufactured in ⅛ and 7/32-inch thicknesses. The ⅛-inch glass will provide a visible light transmittance of 31%. The 7/32-inch sheet provides visible light transmittance of 13% and a radiant energy transmittance of 45-50% which meets the requirements of Federal specifications for heat-absorbing glass, the company states.

The gray glass will substantially reduce the need for supplementary light control measures from blinds, hoods, louvers, or other shading devices. It is recommended for glazing elevations facing east, southeast, west, southwest, and points between, especially those which are subject to exposure by direct sunlight. It is also advantageous for use in ribbon windows and ventilator units in conjunction with light-directing glass block installations, it is said.

According to the manufacturer, the special glare control glass reduces brightness to comfortable seeing levels and also provides a degree of daytime privacy in that it is easier to see through it to the outside than it is to see from the outside in, whenever outer illumination is greater than that of the interior.

More information? Circle Item 64, postcard, last page.

FOR MORE TO WORK WITH ... WORK WITH HONEYWELL

For your mechanical systems...
Honeywell's New Two-Position Fluid Power Valve

It's silent and ⅓ smaller than ordinary

This new Electric Control Valve uses Fluid Power—an entirely new valve operating principle that produces two-position control in a smaller size. Operation is silent, with absolute freedom from maintenance or repair of the power unit. Because of the many exclusive new features of this Honeywell Fluid Power Valve, automatic control can now be applied where it has never before been possible or economically practical. This new valve is especially suitable for radiators, convectors and fan-coil units used for heating, cooling or year-round operation. And this new Honeywell Fluid Power Valve now makes modernization changeover to automatic control simple, inexpensive and trouble-free.

New V8025 Two-Position Fluid Power Electric Valve.

Wraps Itself Around Pipe

A urethane thermal insulation that wraps itself around pipe is announced by National Aniline Div., Allied Chemical Corp., New York, N. Y. According to the manufacturer, its low k factor, high resistance to physical damage, and resistance to chemicals and solvents makes it highly suitable for all refrigeration work and low-pressure (5 psig) steam lines. It is designed for service

between minus 200 and plus 250 deg F.

Insulation does not fray, crumble, or break in handling; neither does it disintegrate when subjected to water or many other liquids, and on drying, the insulation is as good as new, the company states. Preformed to fit pipelines and fittings, its outside diameter is such that it will nest correctly with a second layer, in case heavier thicknesses of insulation are desired. The dual-layer procedure also permits staggering of joints to reduce heat loss to a minimum. The foam insulation requires only one seam. It readily deforms to be slipped over pipes and fittings, then immediately goes back to its original shape.

More information? Circle Item 65, postcard, last page.

Heavy Gage Elbows

Heavy gage sheet metal elbows with no transverse seams, said to be perfectly uniform in every detail, are now fabricated by Consolidated Ventilating & Duct Co., Inc., Jackson Heights, N. Y.

Elbows are die-stamped in two halves and both spot- and arc-welded together. Designed for high pressure air conditioning systems, they are well suited for fume and dust collecting systems, materials handling, and other industrial applications where round ducts or spiral wound pipe is used, according to the manufacturer.

Available in sizes from 3 through 12-inch diameters, and in a variety of gages, these elbows are claimed to cause less static pressure loss than conventional built-up elbows do, but that through mass production they cost less.

More information? Circle Item 66, postcard, last page.

electric valves

QUIET—As quiet as the flow of the fluid itself. No whirring of motors or gear trains. No solenoid click. And the valve actually gets quieter with age.

SMALL—Because Honeywell's new Fluid Power Valve is 1/3 smaller than even the most compact of old-style electric-motor valves, it makes possible automatic control in tight places—places where automatic control has been impossible before.

RELIABLE—No moving parts to wear out. No oiling is necessary. Honeywell's new valve lasts for years and years, saves more than its original cost on service alone.

RUGGED—Stem-and-seat construction as in the best commercial valves. Closes tight, lasts a lifetime.

FAST—This new two-position valve goes from fully open to fully closed or back again in four seconds flat—1/5 the operating time of electric motor valves.

To control Honeywell's new valve, specify the world's most popular thermostat—the Honeywell Round. Neat, unobtrusive, its beauty reflects the watchlike accuracy with which it's made.

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NEW DESIGNED, WIDER RANGE

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D-H AIR-COOLED CONDENSERS

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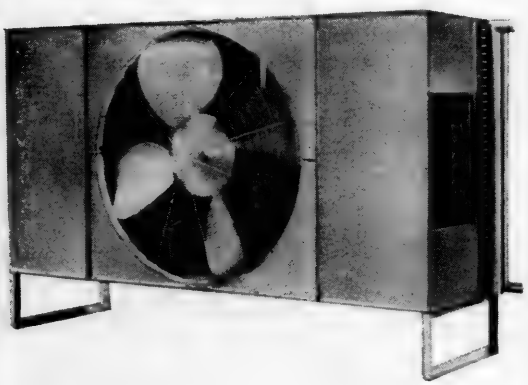
MULTI-CIRCUIT APPLICATIONS



STANDARD SELF-CONTAINED, REMOTE MODELS, 3 TO 25 TONS. RANGE UNLIMITED BY DUPLEXING. INDOOR-OUTDOOR REFRIGERATION OR AIR CONDITIONING JOBS! "DRAW-THRU" PRINCIPLE. TOTALLY ENCLOSED MOTORS. FANS, NAFM-RATED. FAN GUARDS HEAVY WIRE, 'N PLATED. ANGLE-IRON MOUNTING STAND. FEATURES GALORE, ASK US MORE.

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BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

SUMMER AIR CONDITIONING

An excellent book on the fundamentals of summer air conditioning for residences has been published under the authorship of Seichi Konzo, J. Raymond Carroll, and Harlan D. Bareither, all of the Mechanical Engineering Department of the University of Illinois.

The material, prepared especially for the use of the U. S. Armed Forces Institute, includes numerous problems, none of which requires more than a knowledge of arithmetic, and the answers to which appear in a section in the back. Consequently, the book is useful for home study, and probably will be of special help to salesmen, contractors and others who do not require a more highly technical text.

The book is profusely illustrated by drawings which, because of their clearness and the skill with which they were drawn, add much to the presentation.

Chapters include those on Indoor Comfort Conditions for Summer; Summer Weather; The Sun in Relation to the House; Methods of Cooling a House; The Compressor System in Packaged Form; Fan for Circulating Cool Air; Duct Systems for Carrying Air; Distributing Air in Rooms; Noise Control for Air-Conditioning Systems; Heat Gain in Houses—Items to Consider; Designing Air-Duct Systems and Selecting Equipment; Operating Cooling Equipment; and The Air-Conditioning Industry.

Summer Air Conditioning, by Konzo, Carroll, and Bareither, 6 x 9 in., clothbound, 554 pages plus a psychrometric chart in insert. Published by Windsor Press (Popular Mechanics), 200 E. Ohio St., Chicago 11, Ill. Price, $7.50.

LIQUID LINE DRIERS

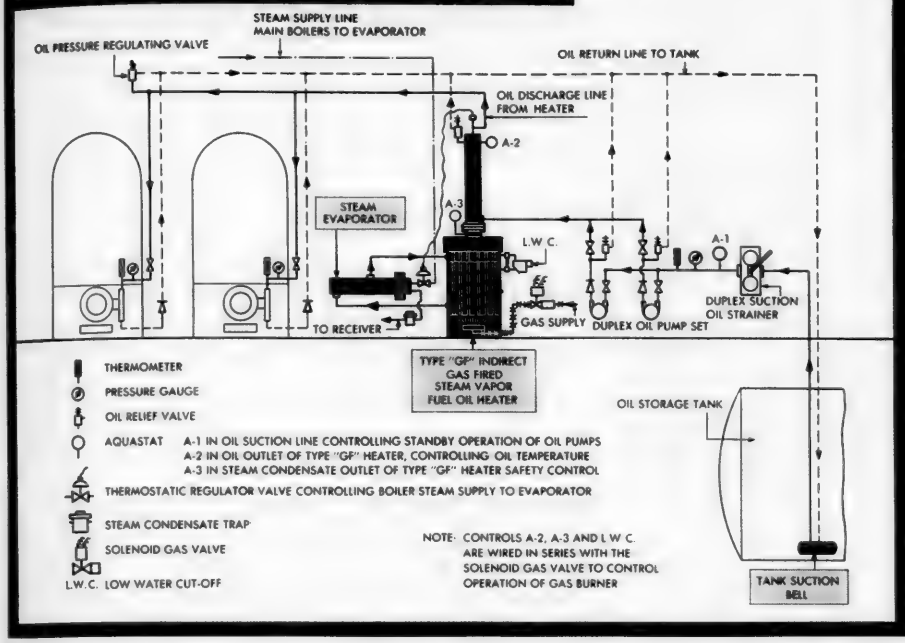
A revision of ARI Standard 710, Liquid-Line Driers contains a completely new procedure for establishing capacity ratings of refrigerant driers based on a statistical treatment of test data. Under the revised standard, now known as ARI Standard 710-58, the alternate water-capacity rating procedure contained in the previous edition (710-56) and based on the amount of refrigerant charge contained in a system, has been deleted.

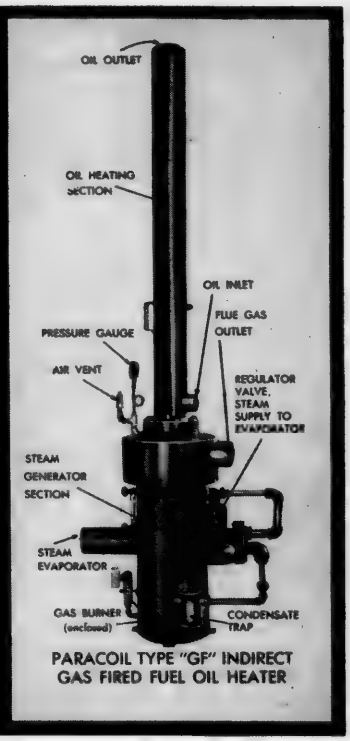
Explaining the changed method, a foreword points out that "The limiting factors in the selection of a drier for a given application are water capacity, refrigerant-flow capacity, and filter capacity. While this standard contains provision for determining water capacities and refrigerant-flow capacities, no attempt has been made to rate filter performance becaues there is insufficient data presently available regarding the subject of filtration.

"It is recognized that there is no relationship between the amount of water entering, or requiring removal from, a given refrigeration system and the size of that system, since the amount of water in a system is a variable and unknown quantity. Therefore as far as drying ability is concerned, a drier cannot be rated dependably in terms

(Continued on page 138)

Idea no. 3 from Paracoil


STEAM SUPPLY LINE
MAIN BOILERS TO EVAPORATOR
OIL PRESSURE REGULATING VALVE
OIL RETURN LINE TO TANK
OIL DISCHARGE LINE FROM HEATER
A-2
A-3
STEAM EVAPORATOR
L.W.C.
A-1
TO RECEIVER
GAS SUPPLY
DUPLEX OIL PUMP SET
DUPLEX SUCTION OIL STRAINER
TYPE "GF" INDIRECT GAS FIRED STEAM VAPOR FUEL OIL HEATER
OIL STORAGE TANK
THERMOMETER
PRESSURE GAUGE
OIL RELIEF VALVE
AQUASTAT A-1 IN OIL SUCTION LINE CONTROLLING STANDBY OPERATION OF OIL PUMPS
A-2 IN OIL OUTLET OF TYPE "GF" HEATER, CONTROLLING OIL TEMPERATURE
A-3 IN STEAM CONDENSATE OUTLET OF TYPE "GF" HEATER SAFETY CONTROL
THERMOSTATIC REGULATOR VALVE CONTROLLING BOILER STEAM SUPPLY TO EVAPORATOR
STEAM CONDENSATE TRAP
SOLENOID GAS VALVE
L.W.C. LOW WATER CUT-OFF
NOTE: CONTROLS A-2, A-3 AND L.W.C. ARE WIRED IN SERIES WITH THE SOLENOID GAS VALVE TO CONTROL OPERATION OF GAS BURNER
TANK SUCTION BELL



PARACOIL TYPE "GF" INDIRECT GAS FIRED FUEL OIL HEATER

Preheat No. 6 Oil with Safety, using BOILER STEAM and AUXILIARY GAS-GENERATED STEAM

Installation and Operation are less costly!

- ***High operation costs of an all-electric No. 6 oil preheating system can be avoided by use of the Type "GF" Indirect Gas Fired Fuel Oil Heater!***
- ***No flame is in contact with oil tubes! Gas is used to generate a supply of steam to heat the oil.***
- ***Secondary evaporator eliminates use of gas entirely when main boiler is operating.***
- ***High viscosity oils are always maintained at atomizing temperatures.***

The Problem

Many No. 6 fuel oil burner systems operate on weekdays only, shutting down in whole or part over weekends and holidays. In such installations, special facilities are necessary to maintain adequate oil temperatures during the standby hours to enable the burners to start promptly and easily when the working period resumes.

In a typical standby system, oil is circulated by intermittent pumping between the burners and the storage tanks and is heated either by periodic boiler firing or by an all-electric system. Both are effective—but boiler heating necessitates firing a large boiler under most inefficient conditions, while an electrical system is extremely costly both to install and operate.

The Solution

Fast, effective, economical standby heating can be provided by a Paracoil system employing a **gas fired heater** (Type "GF"), a **tank suction bell** and a **secondary steam evaporator.**

The Gas-Fired Heater. The Paracoil "GF" Heater always maintains oil in its oil heater section at the proper burning temperature. This heated oil is always available for immediate circulation when needed to maintain pumping temperature in the oil circulation lines or when required to start the oil burners. In addition to maintaining oil at the proper burning temperature, the "GF" heater combined with secondary evaporator serves as a safety device which isolates the oil heater from contact with the primary steam generating system. Thus it is impossible to contaminate the main steam system or boilers with oil in event of an oil tube failure.

Tank Suction Bell. Heated oil is recirculated to a suction bell in the storage tank. Here it mixes with and heats oil to be withdrawn, maintaining a ready supply of fuel at pumping temperatures at all times.

Steam Evaporator. When the main boiler is in operation, boiler steam enters the steam evaporator and generates secondary steam which then takes over the fuel oil heating load. Concurrently, the Type "GF" heater cuts out, thus conserving gas when steam is available from the main boiler.

Paracoil engineers have designed and built many safety-type oil preheating systems. Their experience and know-how is at your service. Write for further information.

DAVIS ENGINEERING CORPORATION

30 Rockefeller Plaza, New York 20, New York • Circle 6-5650

cut along dotted line and save

(Continued from page 136)

of the refrigerating capacity of the system to which it will be connected. . . ."

On this basis, the standard establishes a rating procedure based on a statistical treatment of test data.

Liquid Line Driers. Published by Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington, D. C. Prepared under supervision of the Refrigerant Driers Committee of the ARI Valves, Driers, Fittings and Accessories Section, M. J. Meiklejohn, McIntire Company, chairman. Price, 50 cents.

HEAT-OPERATED AIR-CONDITIONERS

Recognizing the development of new types of heat-operated air-conditioning units, Air-Conditioning and Refrigeration Institute has issued the first ARI Standard for such units. Titled ARI Standard 250-58, Unitary Heat-Operated Air-Conditioning Equipment, the new standard applies to units whose major energy input is in the form of heat—either directly from gas or oil combustion, or from such energy sources as hot water, steam, or electric resistance units.

The new standard applies to factory-made residential, commercial, and industrial heat-operated air-conditioners or matched assemblies which normally include an evaporator or air-cooling coil, a heat-operated cooling apparatus, and may include a heating function as well.

The publication does not apply to the rating and testing of individual assemblies, such as boilers or coils, for separate use. Where such equipment is provided in more than one assembly, the separated assemblies are designed to be used together, and the requirements of rating outlined in the standard are based on the use of matched assemblies.

Unitary Heat-Operated Air-Conditioning Equipment. Published by Air-Conditioning and Refrigeration Institute, 1346 Connecticut Avenue, N. W., Washington 6, D. C., Price, 35 cents.

EXPANSION JOINTS

The Expansion Joint Manufacturers Association has published a book entitled Expansion Joint Standards which contains up-to-date information concerning design, construction, application and testing of expansion joints for piping and other services. Much of this information has never been published in any text or reference book, and for this reason will be of value to those who specify and install expansion joints of the types covered.

The data contained in this first edition was compiled by the technical committee of the Association under the chairmanship of Harvey A. Weinberg, Foster Wheeler Corp. Other engineer-members of the committee are: Robert B. Hill, Adsco Div., Yuba Consolidated Industries, Inc.; Lawrence C. Paul, Badger Fire Extinguisher Co.; Clifford H. Hahn, Badger Mfg. Co.; Robert Armistead, Cook Electric Co.; George I. Hipple, Flexonics Corp.;

(Continued on page 140)

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Layout—Tab Cutting—Hole Punching —Spot Welding—Riveting—Etc. Results in a Savings Up to 70% over old methods.
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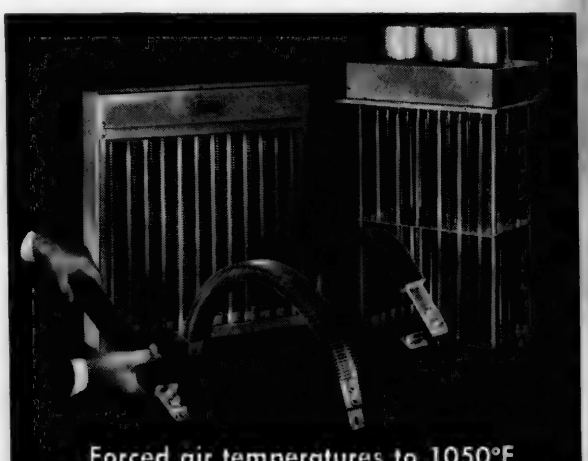

CHROMALOX *Electric* **Air Duct Heaters**

For space heating or for adapting present air conditioning systems for central heating, here is the efficient, economical answer.

Heaters can be installed quickly and easily in round or rectangular ducts and controlled either manually or by automatic thermostat.

115, 208, 230, 460 volts. 91 *standard stock* types, sizes and ratings ready for immediate delivery.

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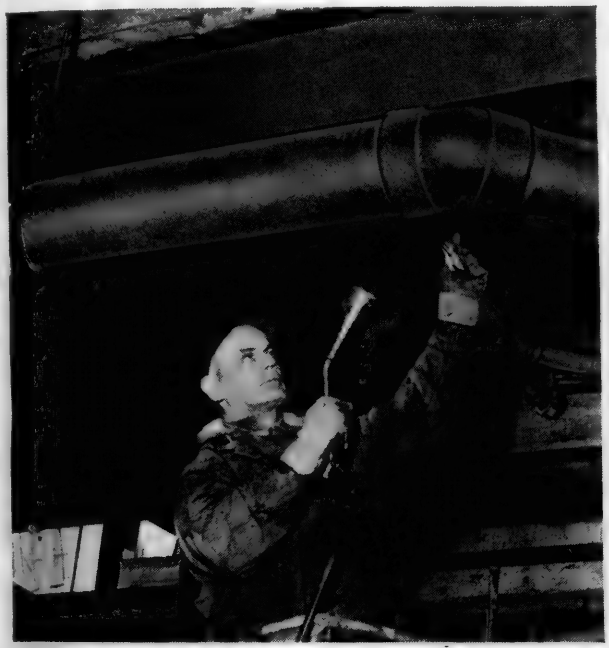
EDWIN L. WIEGAND COMPANY
7588 Thomas Boulevard • Pittsburgh 8, Pa.

COPPER

simplifies plumbing in big addition to Children's Hospital, Pittsburgh

ARCHITECT'S RENDERING of Children's Hospital Addition (foreground) at Pittsburgh. *Architect*: Alfred D. Reid Associates, Pittsburgh. *Consulting Engineer*: J. A. Murray, Pittsburgh. *Plumbing Contractor*: Sauer, Inc., Pittsburgh.



MAKING A SOLDER JOINT on an 8-inch copper soil and waste line – the largest size used in the drainage system. Solder-joint connections are one of the important reasons why copper tube systems are so much easier and faster to install.

TESTING A VALVE on the hot-water supply system. Other copper tube lines in view are part of the sanitary drainage system, ranging in size from 1½ inches to 4 inches. Because connections are easily made, even in tight quarters, the lines can hug the ceiling.

SOME 70,000 pounds of Anaconda copper tube were used in the sanitary drainage system, hot- and cold-water lines, oxygen, vacuum, and compressed-air lines of the addition to Children's Hospital in Pittsburgh.

Copper plumbing provides the advantages of easier, faster installation, with additional economies in design and construction made possible by the lighter weight of copper tubes and the trim, space-saving, solder-joint fittings. Equally important, however, are the long-range benefits. Copper tube systems last longer, require less maintenance than systems of other materials.

Everyone benefits with all-copper plumbing. Architects have greater freedom in design to locate bathrooms and utilities where desired without sacrificing useful space. Contractors report that installation time has been reduced up to one-half – and their men prefer working with copper tube. Owners get plumbing that lasts – costs little to maintain.

Anaconda Copper Tubes are available in all standard wall thicknesses – Types K, L, M, and DWV (Copper Drainage Tube) – through plumbing wholesalers. There's a full line of Anaconda wrought and cast solder-joint fittings. For more information on ALL-COPPER plumbing, write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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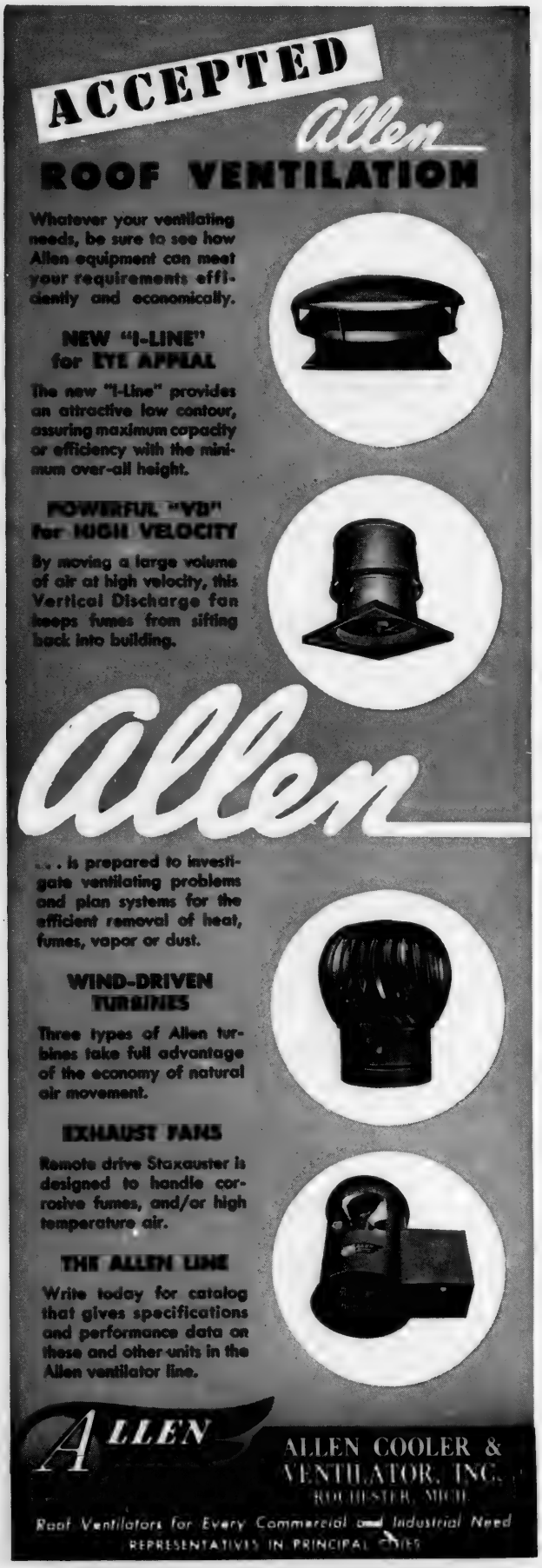
COPPER TUBES AND FITTINGS

Products of **THE AMERICAN BRASS COMPANY**

Available through Plumbing Wholesalers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ROOF VENTILATION
Whatever your ventilating needs, be sure to see how Allen equipment can meet your requirements efficiently and economically.
NEW "I-LINE" for EYE APPEAL
The new "I-Line" provides an attractive low contour, assuring maximum capacity or efficiency with the minimum over-all height.
POWERFUL "VD" for HIGH VELOCITY
By moving a large volume of air at high velocity, this Vertical Discharge fan keeps fumes from sifting back into building.
Allen
. . . is prepared to investigate ventilating problems and plan systems for the efficient removal of heat, fumes, vapor or dust.
WIND-DRIVEN TURBINES
Three types of Allen turbines take full advantage of the economy of natural air movement.
EXHAUST FANS
Remote drive Staxauster is designed to handle corrosive fumes, and/or high temperature air.
THE ALLEN LINE
Write today for catalog that gives specifications and performance data on these and other units in the Allen ventilator line.
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ALLEN COOLER & VENTILATOR, INC.
ROCHESTER, MICH.
Roof Ventilators for Every Commercial and Industrial Need
REPRESENTATIVES IN PRINCIPAL CITIES

(Continued from page 138)

Victor Kopperman, Joseph Kopperman and Sons, Inc.; Harold R. Ehlers, Solar Aircraft Co.; and James Zallea and Charles R. Eisenstein, Zallea Brothers.

Expansion Joint Standards, 8½ x 11 in., with semi-flexible simulated leather cover, 32 pages. Price, $1.00, postpaid. Published by Expansion Joint Manufacturers Association, 53 Park Place, New York 7, N. Y.

REFRIGERATION AND AIR CONDITIONING

In this book, one of the publisher's series on mechanical engineering, and written by a member of the staff of the University of Illinois, emphasis is on the modern concept of the subject as a synthesis of the fundamentals of thermodynamics, heat transfer, and fluid mechanics. While the commercially important vapor-compression cycle is emphasized, special types of refrigeration systems are treated concisely. Principles of heat transfer are included to analyze the performance of actual equipment.

The book, intended as a college text, immediately captures the student's interest by showing him some of the more important applications of refrigeration and air conditioning, as well as the diversity and magnitude of the industry. The technical part of the book begins with basic cooling processes, to understand which the reader must clarify in his mind certain fundamental thermodynamic concepts.

Many variations of multipressure refrigeration systems are shown to be soluble by straightforward mass and heat balances. A review and extension of the student's work on the fundamentals of fluid mechanics are provided in the sections on centrifugal compressors, flow with friction in a capillary tube, and shock waves in a steam-jet compressor.

The fundamentals of heat transfer are required in the chapters on condensers and evaporators. Predicting the performance of the complete vapor-compression system is viewed from the standpoint of solving, graphically, simultaneous equations representing the performance of individual components of the system. The chapters on special types of systems such as the absorption, air cycle, and low-temperature units introduce such concepts as equilibrium conditions of two volatile substances, expansion of moist air, and properties of real substances.

Predicting coil performance is first shown in a complete discussion illustrating the fundamentals. Then practical methods of presenting coil performance data are correlated with the fundamental method. Adequate tables and charts for properties of air-vapor mixtures and refrigerants in the Appendix, make the book self-sufficient.

The author, W. F. Stoecker, assistant professor of mechanical engineering at Illinois, has combined teaching and research with summer work for Battelle Memorial Institute, American Locomotive Company, National Warm Air Heating and Air Conditioning Association, du Pont, and The Trane Company. He is the author of various reports of research work on heat pumps and cooling coils.

Refrigeration and Air Conditioning, by W. F. Stoecker. Cloth bound, 6 x 9 inches, 379 pages plus inserted charts. Published by McGraw-Hill Book Co., Inc., New York, N. Y. Price, $8.00.

(Concluded on page 154)

When the first rocket zooms to the moon, Mr. Readi-Pakt might very well be riding it! That's because our hero makes a habit of getting places. So does Reading Tube's delivery system, which speeds Reading quality products to you through a continent-wide network of distribution depots. Renowned Reading quality in copper and brass tube and pipe is the result of C.Q.C. (Complete Quality Control). It's achieved through step-by-step supervision by specialists in a mill that's wholly integrated — from its own refinery to its own depots. And though Mr. Readi-Pakt doesn't ride personally with every delivery, you always have the assurance of Reading's famous personalized service!

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READING COPPER BRASS TUBE
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MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

profits come packaged:

Cleaver-Brooks Progress boilers pay off in time and labor savings

PROGRESS BOILER PROVES good things come in a *complete* package — especially when it comes to boilers. No need for you to do the manufacturer's work. No costly time-waste, boiler-building on the job!

Because Progress is a completely pre-engineered, factory-tested package — ready for hook-up to service lines — you save up to two days on installation alone.

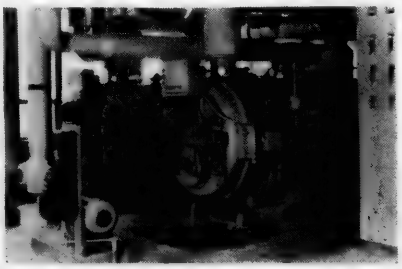
PROFITS PROVE THE PACKAGE

And when it comes to worry-free installation, Cleaver-Brooks leaves nothing undone. Field starting service is just one example. A Cleaver-Brooks technician starts the boiler, trains the boiler attendant at no extra cost.

And Progress is easy to sell with quiet, low-cost operation. Four-pass, forced draft design means guaranteed efficiency; electronic controls, soft flame start.

The Progress boiler is built to the standards of industrial boilers. Available in 7 sizes to 2,010,000 Btu — oil, gas or combination oil/gas fired models.

You'll profit as a Progress contractor. For your Progress *Cooperative Wholesaler* contact your local Cleaver-Brooks sales representative listed in the yellow pages, or write Cleaver-Brooks Company, Dept. L, 315 E. Keefe Ave, Milwaukee 12, Wisconsin.



Cleaver-Brooks boilers are available in 19 sizes, 130 models, 15 to 600 hp. — steam or hot water, gas, oil or combination oil/gas fired. Illustration shows Model CB boiler as installed at Whirlpool Corp., St. Joseph, Michigan.

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TO MAKE PROGRESS SELL PROGRESS

NEW CATALOGS

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

COOLING COILS—American Air Filter Co., Inc., Louisville, Ky., offers a bulletin describing its complete line of Herman Nelson cooling coils. Bulletin No. 880 contains complete coil selection information, as well as construction specifications, dimensional data, surface charts, and circuiting diagrams.

Circle **Item 67** on Inquiry Card

ELECTRIC HEATERS, DEVICES—Catalog describing electric heaters and heating devices available from General Electric Co., Schenectady, N. Y., supplies answers for hundreds of heating problems and helps expedite product delivery by clarifying ordering information. The 52-page booklet is designated GEC-10051.

Circle **Item 68** on Inquiry Card

HEAVY-DUTY COMPRESSORS—Bulletin No. 112-J, published by Frick Company, Waynesboro, Pa., describes applications and specifications of heavy-duty compressors for all types of refrigeration service. The bulletin illustrates many typical installations and uses of this type compressor.

Circle **Item 69** on Inquiry Card

FIRE RELIEF UNITS—A folder describing the company's Pyrojector is available from The Swartwout Co., Cleveland, Ohio. This automatic heat, smoke, and explosion relief unit is fully explained with photographs and engineering specification data.

Circle **Item 70** on Inquiry Card

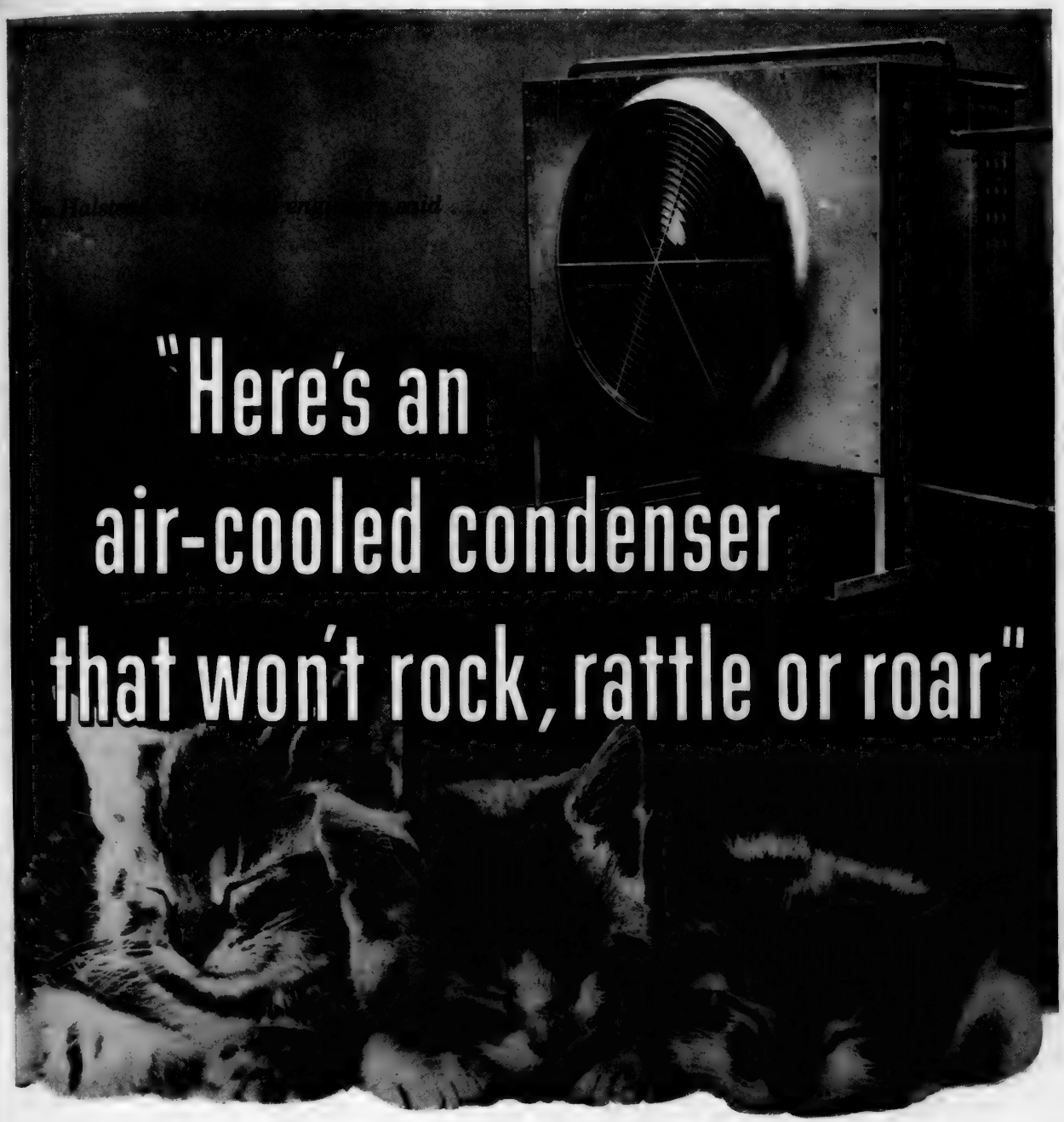
FLOW SWITCHES—Bulletin FS-1, published by McDonnell & Miller, Inc., Chicago, Ill., covers the company's line of flow switches. Included are details of construction, dimensions, electrical ratings, and a diagrammed group of typical applications.

Circle **Item 71** on Inquiry Card

TUBE FITTINGS AND VALVES—A 112-page catalog, No. C-12, published by The American Brass Co., Waterbury, Conn., gives information on Anaconda copper tube fittings and valves. Roughing-in measurements and suggestions for installation are included.

Circle **Item 72** on Inquiry Card

(Continued on page 144)



"Here's an air-cooled condenser that won't rock, rattle or roar"

They planned it that way. H&M Air-Cooled Condensers had to be free of the vibrations, rattles and fan noise that plagued so many competitive models. And comments from contractors and users prove they hit their target.

The extra rugged casing won't loosen with use. Lock-tight construction avoids annoying rattles. Four-bladed, deep pitch fans are driven at slow speed for really quiet operation.

Halstead & Mitchell condensers are dependable, too. Large coil and exclusive Turbu-Flo design add more surface, improve heat transfer by up to 15%. Wide fin spacing prevents condenser clogging by dirt or other air-borne particles.

Designed for use with Refrigerants 12 or 22, H&M Air-Cooled Condensers are available in twelve models, from 3 to 50 tons capacity. Floor or ceiling mountings. Multiple circuiting for specified requirements, at no extra cost. Centrifugal Fan models are available for inside installations requiring ductwork.

Ask for H&M Air-Cooled Condensers at your distributors, or write for literature. Halstead & Mitchell, Bessemer Bldg., Pittsburgh 22, Pa.

HM

Halstead & Mitchell

Air-Cooled Condensers • Cooling Towers • Water-Cooled Condensers • Finned Coils

for DUST

CONTROL

install

FLEXAUST®

HOSE

Made of strong neoprene coated cotton or nylon fabrics spiral wire reinforced.
For *all* kinds of dust collecting uses, particularly good for elbows and moving hoods.
Exceptionally easy to cut, install, connect, reuse, and relocate.
Sizes 1¼" thru 36" i.d.

Write for details today
Distributors in all principal cities

THE FLEXAUST COMPANY
Dept. HV-10
100 PARK AVE. NEW YORK 17, N. Y.

NEW CATALOGS

(Continued from page 142)

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

MULTI-PATTERN AIR DIFFUSERS — Selection tables, performance charts, and other engineering data for multi-pattern air diffusers are presented in a comprehensive, 64-page manual offered by Universal Diffuser Corp., Tuckahoe, N. Y. Stress is on proper selection and application for any requirement.

Circle **Item 73** on Inquiry Card

AUTOMATIC CONTROLS — Barber-Colman Co., Rockford, Ill., announces a new edition of its automatic controls catalog for air conditioning, heating and ventilating systems. Catalog 26, in 52 pages, provides operational and application data, incorporated with the description of each control component.

Circle **Item 74** on Inquiry Card

TUBEAXIAL FANS—Performance and dimension specifications on the company's Series 300 tubeaxial fans are available in Catalog 1110-B, prepared by Sturtevant Div., Westinghouse Electric Corp., Boston, Mass. Included are recommended stack sizes, maximum horsepower and maximum motor speed for variable stack velocity and air flow output.

Circle **Item 75** on Inquiry Card

TANKLESS WATER HEATER—A catalog, from Portmar Water Heater Co., Inc., of Brooklyn, N. Y., describes company's Series WH twin-coil volume water heater, which supplies large quantities of instantaneous automatic hot water without a storage tank. Included are installation data, capacities, and dimensions.

Circle **Item 76** on Inquiry Card

RELIEF VALVE SELECTION—"Capacity computer" and "relief valve selector" slide chart for refrigerant pressure vessels is announced by Henry Valve Co., Melrose Park, Ill. The computer side accurately determines the required ASA B9.1 Code capacity, number, and pressure setting of relief valves. The selector, on the reverse side, determines the correct size Henry relief valve, and the size and maximum length of discharge piping in accordance with code requirements.

Circle **Item 77** on Inquiry Card

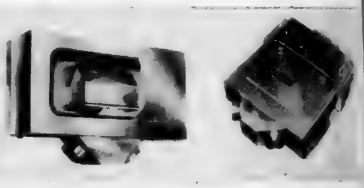
(Continued on page 146)

BUENSOD DUAL-DUCT UNITS, NOTED FOR FLEXIBILITY, CONDITION YEAR-AROUND

In the photograph on the facing page, the familiar tools of your profession symbolize the heart of one of the most flexible air conditioning systems ever developed. The system is the high pressure Dual-Duct method. Simply and efficiently it cools, heats, humidifies or dehumidifies a building. And it provides widely varying temperature and humidity conditions, where desired, from room to room.

The problem was to make such a system *stable*. Buensod engineers invented *direct, automatic volume control.* As pressures in the system change, each mixing unit automatically adjusts to maintain a constant quantity of air.

The action is something like the compass in our photograph on the adjacent page. That's how simple it is — but this is inspired simplicity, for the automatic volume control permits quick balancing of an entire system merely by adjusting spring tension at the time each unit is installed. Or we can pre-balance an entire system at our factory, saving time on your job.



Type V3 Air Mixing Unit for under window or wall mounting.

Type H unit for overhead installations

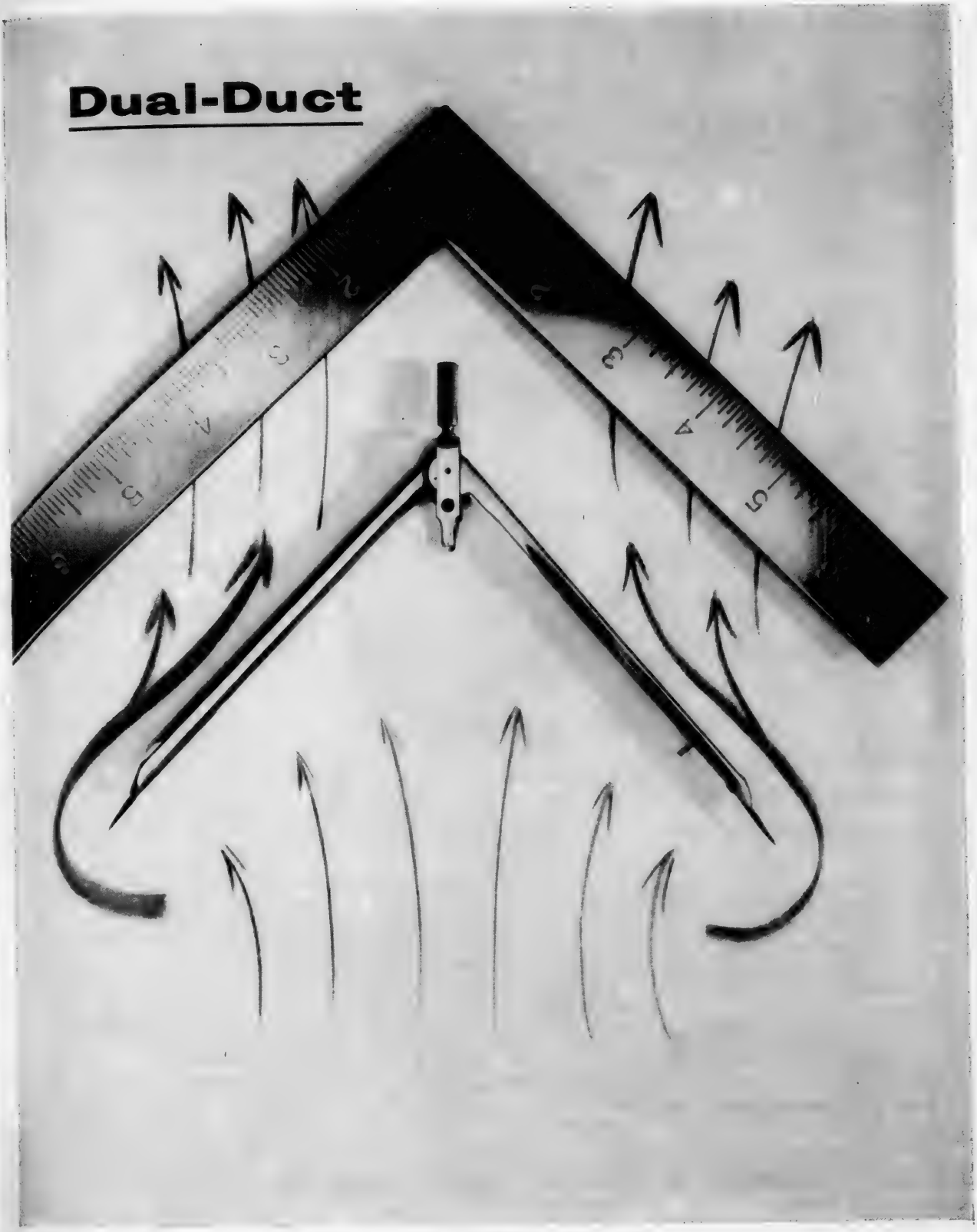
Buensod Dual-Duct Air Mixing Units offer true simplicity in air conditioning. We'd like to provide you with full technical details. Please contact our local representative, or write us directly.

BUENSOD-STACEY, INC.
45 West 18th Street • New York 11, N.Y.

BUENSOD-STACEY INCORPORATED

SIM

in air



PLICITY

conditioning DESIGN

NEW CATALOGS

(Continued from page 144)

SELF-CONTAINED CONDITIONERS — Governair Corp., Oklahoma City, Okla., offers a 24-page catalog describing its self-contained air conditioning unit (SCU) which serves as a base for three comparable types of equipment: self-contained unit with shell and tube condenser; water chiller unit with evaporative condenser; and multizone unit with evaporative condenser. Comprehensive selection tables are included.

Circle **Item 78** on Inquiry Card

FORGED STEEL UNIONS — Clayton Mark & Co., Evanston, Ill., has published a 16-page, loose-leaf style folder providing complete information on its full line of forged steel unions and union fittings.

Circle **Item 79** on Inquiry Card

IMMERSION STEAM BOILERS—Bulletin 5208, from Sellers Engineering Co., Chicago, Ill., gives general specifications and sizes of company's Model 77-D packaged immersion steam boilers. It also describes the action and advantages of immersion firing.

Circle **Item 80** on Inquiry Card

for satisfied customers and more sales volume.

sell

ZONVALVE

the best in modern

ZONED HEAT

ZONED HEAT means:
more comfort, less fuel!

Zoned heat is now recognized as the ultimate in modern heating. Its advantages are two-fold:

1) *Comfort* – each area of the home or building may be heated automatically to the desired temperature.

2) *Economy* – heating plant need no longer burn fuel to furnish unwanted heat.

ZONE CONTROL VALVES are the most *economical* devices for accomplishing zone heating control. With them, multiple zones may be individually controlled from a single burner and circulator.

Each zone is controlled by its own thermostat. All wiring is inexpensive low-voltage.

ZONVALVES mean:
more profits, better jobs!

ZONVALVE is a zone-control valve of *outstanding quality*, as well as extremely low price.

Zonvalve is thermostatically operated. All Zonvalves contain a built-in auxiliary switch, which *automatically* starts circulator or burner, when any Valve is in "open" position.

Zonvalve may be installed in any position on supply piping or individual radiator. In modernization, Zonvalve replaces the ordinary radiator valve with *no piping change*, no shutdown of heating system.

Zonvalve is compact, rugged in construction. It is manufactured in standard tubing and pipe sizes. Operates on steam and hot water systems. *Unconditionally guaranteed.*

Zonvalve is ideal for zoned heat in homes, offices, factories, hospitals, hotels and motels.

For fast sales, *sell Zonvalve!*

For full details, ask your wholesaler or write for Brochure D-9.

HEAT-TIMER CORP. - 657 BROADWAY, NEW YORK 12, N.Y.

ELECTRONIC COMPUTERS—One of the most important advances in the use of electronic computers by business is described in a 115-page manual issued by Remington Rand Univac Div., Sperry Rand Corp., New York, N. Y. System is called Flow-Matic, and for the first time makes it possible to communicate with computers in the English language, instead of with mathematical symbols.

Circle **Item 81** on Inquiry Card

ACTIVATED CHARCOAL— The Activated Charcoal Story, an 8-page pocket-size pamphlet, available from Barnebey-Cheney, Columbus, Ohio, describes manufacturing processes involved in making activated charcoal, and how it has been developed for liquid and gas purification uses of today.

Circle **Item 82** on Inquiry Card

PIPE INSULATION—Eight-page Form WPN-2, from L.O.F. Glass Fibers Co., Toledo, Ohio, describes lightweight, glass fiber Micro-Lok pipe insulation for temperatures ranging from subfreezing to 350 deg F. It emphasizes advantages, including "spring-hinge" opening and closing, and gives physical properties, thermal conductivity, and guide to application.

Circle **Item 83** on Inquiry Card

METAL TREATMENT FOR RUST—Four-page folder from Rusticide Products Co., Cleveland, Ohio, describes how Ospho, when applied directly to rusted metal, chemically changes rust to iron phosphate, thus preparing the surface for a good bond with regular maintenance paint.

Circle **Item 84** on Inquiry Card

HIGH VELOCITY FILTERS—Bulletin No. 130, from Cambridge Filter Corp., Syracuse, N. Y., describes company's high-velocity Aerosolve filters which, as compared with its standard Aerosolve filters, will handle 80% more air volume per sq ft face area at no increase in pressure drop.

Circle **Item 85** on Inquiry Card

PLUMBING FITTINGS — Kohler Co., Kohler, Wis., announces a catalog on its recently-introduced All-Brass line of fittings in two series: Galaxy and Constellation. Covered in the catalog are shower and bath fittings, lavatory fittings, mixing valve, flush valves, and drains.

Circle **Item 86** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

FAN tas tic

Aeromaster FANS

increase cooling tower efficiency with MORE CFM and LESS HP

Precision engineered Aeromaster Fans with variable pitch blades and anti-flutter design give cooling at *lower cost.* Blades resist acids, alkalies, abrasion and weather. 4, 6 or 8 blade styles in 54″ to 22′ diameters. Before you replace or consider new equipment, write: KOPPERS COMPANY, INC., 6910 Scott Street, Baltimore 3, Md.

KOPPERS Aeromaster Fans

Engineered Products Sold with *Service*

AIR MOVING UNITS—A 16-page bulletin, No. 5412, describing the company's line of special purpose air moving units for original equipment manufacturers, is available from American-Standard, American Blower Division, Detroit, Mich. Products include packaged centrifugal blowers, vaneaxial fans, tubeaxial fans, propeller fans, pressure blowers and fluid coolers.

Circle **Item 87** on Inquiry Card

REFRIGERANT DISTRIBUTORS — Bulletin 20-10, published by Sporlan Valve Co., St. Louis, Mo., covers the company's line of distributing devices for the standard refrigerants. It also contains a new section for reverse cycle, hot gas defrost, and hot gas by-pass systems.

Circle **Item 88** on Inquiry Card

SNOW MELTING SYSTEMS—The use of Dowtherm SR-1 in thermal snow and ice removal systems is described in a booklet issued by The Dow Chemical Co., Midland, Mich. The 20-page manual details the fluid's properties and advantages, and includes information on typical installations and the development and use of snow-melting systems.

Circle **Item 89** on Inquiry Card

FLEXIBLE PIPE JOINTS — A series of four data sheets containing specifications, prices, and installation instructions for flexible, vibration-absorbing, wire-reinforced Neoprene pipe joints is offered by La Favorite Rubber Mfg. Co., Hawthorne, N. J.

Circle **Item 90** on Inquiry Card

HEATING COILS—Catalog 4558, describing the manufacturer's complete line of heating coils, is offered by Young Radiator Co., Racine, Wis. Additional coil sizes are now available to provide a complete range in all types.

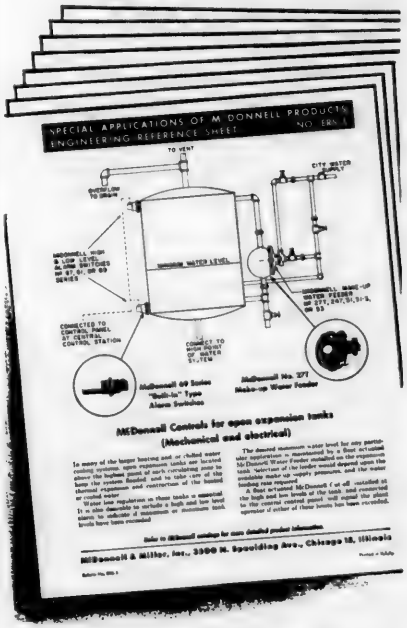
Circle **Item 91** on Inquiry Card

AIR-COOLED HEAT EXCHANGER — A revised edition of the Fluid Cooler (air-cooled heat exchanger) sales catalog is available from The Trane Co., La Crosse, Wis. Two basic models, for vertical or horizontal air flow, and 23 sizes are covered in Catalog S-395. Information is included on equipment which may be specified to operate on a forced or induced draft arrangement.

Circle **Item 92** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

NEW DATA SHEETS


SPECIAL APPLICATIONS OF M DONNELL PRODUCTS
ENGINEERING REFERENCE SHEET
NO. ERS-1
McDonnell Controls for open expansion tanks
(Mechanical and electrical)

—cover special problems solved by McDONNELL products

These recently published engineering reference sheets explain the interesting ways in which engineers are today using McDonnell products to step up efficiency and provide safety in connection with equipment such as:

- Expansion and compression tanks
- Stand-by pumps
- Cooling towers and chilled water systems
- Higher temperature hot water heaters
- Storage tanks and pressure vessels

The simple diagrams and explanations are likely to suggest solutions to many of your operating problems.

***Just say,* "send the ERS sheets."**

McDONNELL & MILLER, *Inc.*
3500 N. Spaulding Ave., Chicago 18, Ill.

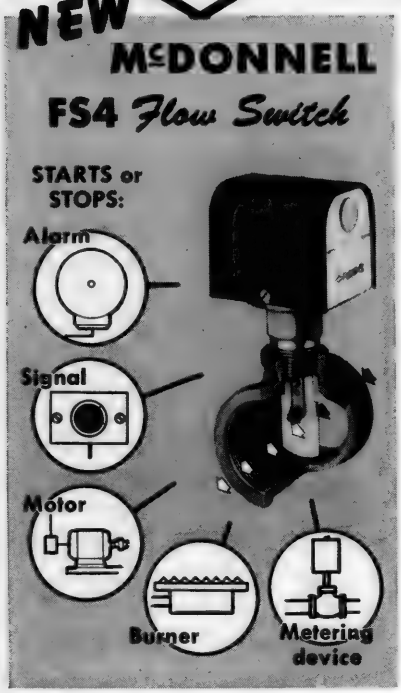
Doing One Thing Well

McDONNELL

Boiler Water Feeders • Low Water Fuel Cut-Offs • Pump Controllers • Flow Switches, Relief Valves • Related Liquid Controls for Tanks, Stills, Air Conditioning Systems

Makes or breaks a circuit *when flow starts* ...or *stops*

NEW McDONNELL FS4 *Flow Switch*



The illustration tells the story of the McDonnell FS4 Flow Switch. Installed in a pipe line, it is a moderately priced, highly dependable device that makes or breaks a circuit when flowing liquid moves the paddle—to perform almost endless functions vital to safety and automatic operation. Underwriters' Listed.

New Bulletin FS-1 fully covers all details of construction and service ranges. Also contains typical applications that may suggest important services the FS4 Flow Switch can perform in your plant.

McDONNELL & MILLER, *Inc.*
3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

McDONNELL *Flow Switches*

Boiler Water Feeders • Low Water Fuel Cut-Offs • Pump Controllers • Relief Valves • Related Liquid Controls for Tanks, Stills, Air Conditioning Systems

NEW CATALOGS

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

OIL BURNERS — Two specification sheets are available from Sun-Ray Burner Manufacturing Corp., Jamaica, N. Y. One describes Models R-8, R-18, and R-33 fully automatic oil burners, with a capacity range from 3 to 33 gph; the other covers Model S3 "shell head" oil burner, with capacity range from 5 to 10 gph.

Circle **Item 93** on Inquiry Card

LEAK DETECTORS—Catalog GEA-6817, published in 12 pages by General Electric Co., Schenectady, N. Y., describes characteristics and applications of four halogen-type leak detectors for locating leaks in any system or component under pressure or vacuum. Special emphasis is given to a new control unit which can be used with any of the four detector heads.

Circle **Item 94** on Inquiry Card

INDUSTRIAL VALVES— The Ohio Injector Co., Wadsworth, Ohio, announces a 28-page condensed version of its General Catalog, listing over 95% of the company's complete line of industrial valves. Supplementary information includes a valve comparison chart which offers a cross reference to the most commonly used figure numbers of ten valve manufacturers.

Circle **Item 95** on Inquiry Card

INDIRECT-FIRED HEATERS—An 8-page brochure, No. 587, by The Brown Fintube Co., Elyria, Ohio, reports how to efficiently and economically heat almost any gas, vapor, or liquid by means of the company's indirect-fired Type 102 heater.

Circle **Item 96** on Inquiry Card

ODOR-METERING APPARATUS—Available from Hemeon Associates, Pittsburgh, Pa., is a brochure describing the development by this organization of an odor-metering apparatus and techniques for its application to industrial odor-control problems.

Circle **Item 97** on Inquiry Card

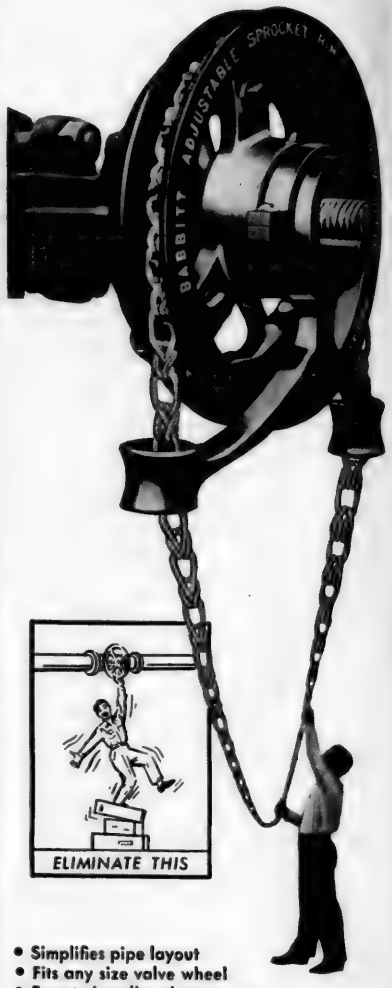
REFRIGERATION PRODUCTS—Offering specifications on its new packaged refrigerants and receiver-drier, Ansul Chemical Co., Marinette, Wis., has published a comprehensive catalog of its complete refrigeration product line. Application and ordering information is included.

Circle **Item 98** on Inquiry Card

SAFE OPERATION OF OVERHEAD VALVES *with a*

Babbit

Adjustable **SPROCKET RIM** *with Chain Guide*



- Simplifies pipe layout
- Fits any size valve wheel
- Easy to install and operate
- Operates any valve from plant floor
- Time and money saving fixture
- No maintenance; first cost *only* cost
- Packed, completely assembled, one to a carton
- Hot galvanized, rust-proof chain available for all sizes
- Easy to follow instructions with each unit
- Your supplier carries complete stocks
- Write for new descriptive catalog sheet and prices

Babbit STEAM SPECIALTY CO
5 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

DRY AIR...
PRECISELY AS YOU WANT IT

The Niagara Controlled Humidity Method using HYGROL Moisture-Absorbent Liquid

Is best and most effective because...it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because...the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Inexpensive to operate because...no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

Write for full information; ask for Bulletins 112 and 121. Address Dept. HV-10.

NIAGARA BLOWER COMPANY
405 Lexington Ave., New York 17, N.Y.
District Engineers in Principal Cities of U. S. and Canada

VARIABLE SPEED CONTROL — A revised, full-color brochure on the operation and application of Varitrol variable speed drive and pneumatic control systems is announced by U. S. Electrical Motors, Inc., Los Angeles, Calif. Featured is company's pre-engineered Varitrol instrumentation package.

Circle **Item 99** on Inquiry Card

INSULATION ADHESIVES—Bulletin 1-C 58, from Insul-Coustic Corp., Maspeth, N.Y., contains information on the company's insulation adhesives, weatherproofing, coatings, vapor barriers, and sealing compounds. Included are data on applications, properties, temperature ranges, coverage per gallon, and general suggestions.

Circle **Item 100** on Inquiry Card

HEAT EXCHANGERS, TANKS—Ellicott Fabricators, Inc., Baltimore, Md., announces 24-page Bulletin 100-A, which covers company's hot water generators, storage tanks, air receivers, blow-off tanks, and special fabrication work. It includes technical data for specifying sizes, capacities and dimensions.

Circle **Item 101** on Inquiry Card

CENTRIFUGAL FANS — A bulletin on four new airfoil-type centrifugal fans is available from Ilg Electric Ventilating Co., Chicago, Ill. Bulletin 257-S gives complete information on all the varieties of speed control on both direct-connected or belt-driven fan models. In addition, it provides construction data, specifications, and capacity tables.

Circle **Item 102** on Inquiry Card

SOLAR SCREENS—Eight standard Ceramic Veneer grille designs, in a wide range of colors, are described in a bulletin offered by Federal Seaboard Terra Cotta Corp., New York, N. Y. Grilles permit design and color versatility in the creation of solar screens or perforated facades for sun control, ventilation, or privacy.

Circle **Item 103** on Inquiry Card

EVAPORATIVE CONDENSERS—Catalog 30C8A, providing information on the company's DF-A series of Dri-Fan evaporative condensers, is available from Recold Corp., Los Angeles, Calif. Included is basic information on dimensions, specifications, and performance in tons for ammonia and refrigerants 12 and 22.

Circle **Item 104** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

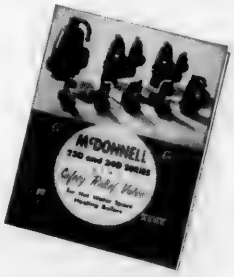
For Every Hot Water Boiler

McDONNELL
A.S.M.E.
Safety Relief Valves

Today's A.S.M.E. Boiler Code calls for certified Btu-rated pressure relief valves...and in the McDonnell line you have this type of valve in its highest development.

New Bulletin P-33 tells the story

Shows how entire rated capacity is obtained without diaphragms or other auxiliary lifting devices. Explains widely adopted McDonnell principle of progressive settings and points out other features that contribute to better performance and greater safety.

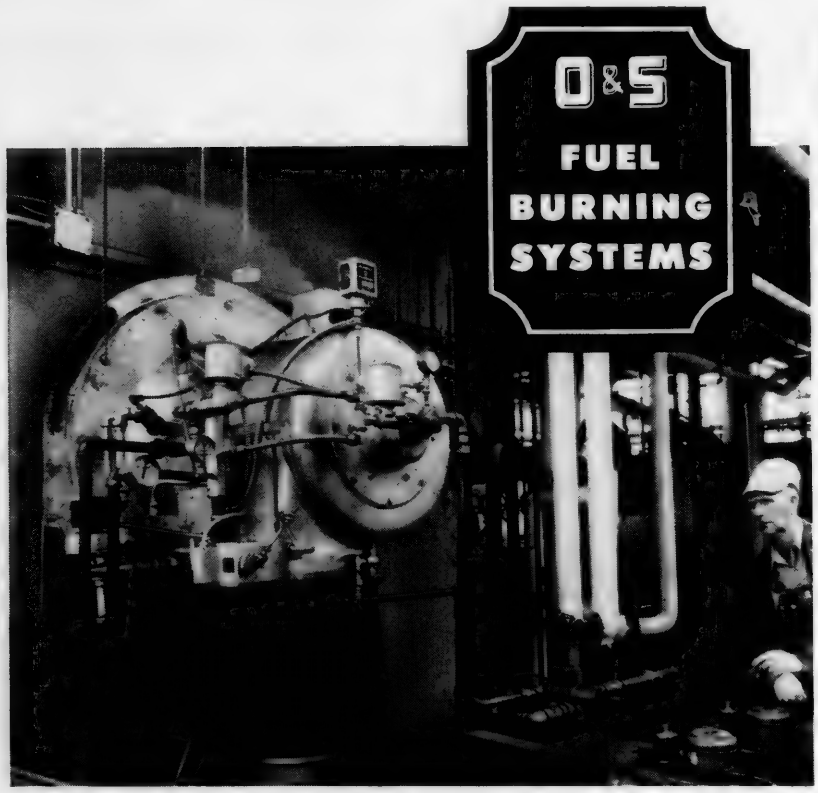


Write for your copy

McDONNELL & MILLER, Inc.
3500 N. Spaulding Ave., Chicago 18, Ill.
Doing One Thing Well

McDONNELL
Safety Relief Valves

Boiler Water Feeders • Low Water Fuel Cut-offs • Pump Controllers • Flow Switches • Related Liquid Level Controls for Tanks, Stills, Air Conditioning Systems



"BEST in 30 years"

For dependable, efficient and trouble-free firing on present boilers or new boilers, install O&S Burner Systems. More and more plants are reaping the benefits of these completely factory packaged firing units.

Like the Pitman-Moore Co. for example. After troublesome experience with coal firing and other oil burners on existing boilers for heating and process steam, this 60-year old leading producer of ethical drugs and pharmaceuticals chose O&S Oil-Gas Burner Systems for *new* boilers at its Indianapolis and Zionsville plants. Selection was influenced by results with a previous installation of same type burner and recommendations of other users. In fact, the O&S Burner was so successful that 3 O&S *Powermaster* Packaged Automatic Boilers will soon be installed in a new Research Center. A fourth *Powermaster* is already in operation in the Virus Research Building.

"I have yet to see better combustion in my more than 30 years' experience with boilers" says the Company's Director of Plant Engineering, George R. Popp, about the benefits gained with O&S Burner Systems. They include: Complete, clean and efficient combustion with No. 6 oil at all firing rates; very high efficiency even at very low loads; greater operating flexibility and speed of recovery; simplicity and ease of adjusting fuel-air ratio; ease of cleaning nozzle; compact, rugged construction; trouble-free operation; and fuel change-over for seasonal cost advantages.

Investigate the advantages of O&S Burner Systems for your boilers. Consult your O&S representative and write for informative bulletin. Orr & Sembower, Inc., Reading, Pa.

O&S

ORR & SEMBOWER, INC.

POWERMASTER/Models 3, 4 and 5...POWER-PAK and BURNERS

NEW CATALOGS

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.

ALUMINUM RIGID CONDUIT — Aluminum Electrical Rigid Conduit, 12-page booklet published by Aluminum Company of America, Pittsburgh, Pa., outlines briefly the mechanical and electrical advantages of aluminum rigid conduit. Although primarily a descriptive brochure, the booklet gives specific installation instructions and a comprehensive table of dimensions and weights of conduit, couplings, and elbows.

Circle **Item 105** on Inquiry Card

ZONE CONTROL PACKAGE—A bulletin describing its zone control package for hydronic heating is offered by White-Rodgers, St. Louis, Mo. Cost comparisons are made for both the conventional system of multiple zone control and the company's system which requires only one circulator and one relay. Flow and wiring diagrams are included.

Circle **Item 106** on Inquiry Card

POWER ROOF VENTILATORS—Describing power roof and sidewall ventilators, Catalog V-58 and associated literature are announced by Carnes Corp., Verona, Wis. The 34-page edition contains engineering drawings, performance data, and capacities. Associated literature includes 13 submittal drawings and 14 sets of performance graphs.

Circle **Item 107** on Inquiry Card

ALL-YEAR USE OF SCHOOLS—A special report on the pros and cons of all-year use of school buildings is available from American Air Filter Co., Inc., Louisville, Ky. Taking no sides in the discussion, Bulletin 600-A12 discusses the all-year school plan from the enrichment viewpoint, and compares yesterday's thinking with today's.

Circle **Item 108** on Inquiry Card

STAINLESS STEEL TUBING — Bulletin 415, published by Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa., explains how welded stainless steel heat exchanger and condenser tubes are made, and also points out the fabrication and service advantages of using fully annealed tubing.

Circle **Item 109** on Inquiry Card

THERMOCOUPLE ACCESSORIES — Catalog G-100-8 describes a complete line of thermocouple accessories, manufactured by Industrial Div., Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., for measuring temperature. Issue includes company's Meg-O-PaK assemblies and new insulated extension wire.

Circle **Item 110** on Inquiry Card

DEAERATING HEATER — A six-page bulletin containing specifications and diagrams of the company's SSC deaerating heater is available from Graver Water Conditioning Co., New York, N. Y. Information on two-stage spray-type packaged heater includes operation, application, and design characteristics.

Circle **Item 111** on Inquiry Card

STANDARDS OF STERILITY—An attractive wall chart, listing standards of sterility to protect hospitals and patients against bacteria, is available from Kathabar Div., Surface Combustion Corp., Toledo, Ohio. Chart covers air conditioner sludge, humidifiers, and soap supply.

Circle **Item 112** on Inquiry Card

AUTOMATIC AIR FILTER—Farr Company, Los Angeles, Calif., announces an 8-page bulletin describing the Far-Air Roll-Kleen, an automatic renewable media air filter. Operation controls relating to automatic filtration are presented, in addition to engineering information and maintenance factors.

Circle **Item 113** on Inquiry Card

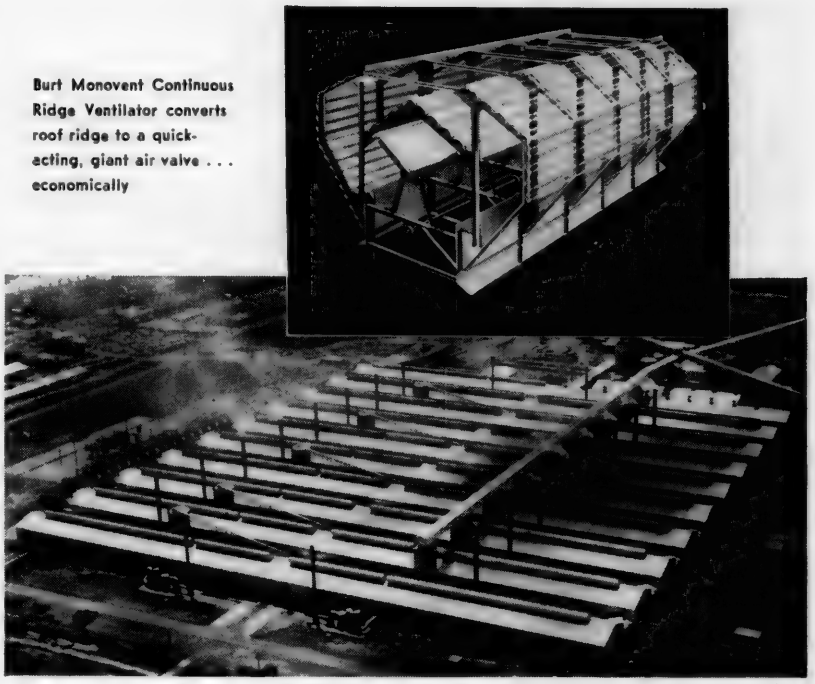
HARD RUBBER PIPE FITTINGS—Bulletin No. PF-1300, describing the company's hard rubber pipe fittings and valves, is issued by The Luzerne Rubber Co., Trenton, N. J. This 8-page booklet contains data on characteristics and handling, as well as diagrams and dimensions of threaded fittings and valves.

Circle **Item 114** on Inquiry Card

FLAME-CUTTING EQUIPMENT—Oxweld flame-cutting equipment is described in a 6-page folder published by Linde Co., Div. of Union Carbide Corp., New York, N. Y. Folder covers manual and machine-cutting equipment for use on every flame-cutting job from thinnest sheet metal to risers 10-ft thick.

Circle **Item 115** on Inquiry Card

Use the prepaid postcard on last page for securing your copies of catalogs described in this department.



Burt Monovent Continuous Ridge Ventilator converts roof ridge to a quick-acting, giant air valve . . . economically

POT ROOM AIR MOVES OUT FAST AT REYNOLDS ALUMINUM

The huge new Reynolds Metals Company's aluminum plant at Sheffield, Alabama, conditions the air in each manufacturing operation with a carefully engineered system of modern Burt Ventilators.

On the pot lines, where the snow-white alumina powder is transformed into aluminum in a bath of molten cryolite—where great crucibles of molten metal swing down the aisles — 84" aluminum Burt Movements keep the air moving out fast. Over 7,200 lineal feet of this continuous ridge type Burt ventilator—more than 1⅓ miles—ventilates the nine pot line buildings uniformly and economically. Nearly 400 lineal feet of 60" Burt Monovent conditions the service building.

Atop the adjoining rectifier building, with its thousands of square feet of electrical equipment, twenty-five 54" aluminum Burt Free Flow Fan and Gravity ventilators provide fast, big-volume exhaust.

Thirty additional aluminum Burt Free Flow Gravity ventilators serve the pin cleaning, coke and ore unloading and carbon paste buildings.

In the big Reynolds installation only two Burt ventilator types were required. Other types and sizes might better solve your air moving needs. You will find them all readily available in the complete line of time-proven, modern Burt Ventilators.

Send for **FREE** *Data Book!*

Write for Burt Data Book SPV-101-G.
It supplies quick data on Burt's complete line of modern Roof Ventilators.

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The Burt Manufacturing Company

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MEMBER AIR MOVING & CONDITIONING ASSOCIATION, INC.

TYPE AL furnace limit control

Adjustable and non-adjustable. Bimetal sensing element is maintained in a completely exposed position in the air stream for fast temperature response. Temperature calibration and differential can be preset to your specifications up to 300° F. Standard factory differential is 25° F. Can be supplied with a closer or wider differential on request. Adjustable feature at no extra cost. Standard range of adjustment is 90° F. 40° F. range also available. Furnished with either 3-inch (AL-3) or 7-inch (AL-7) probe.

NEW
THERM-O-DISC THERMOSTATS
for furnace fan and limit control applications

TYPE AF furnace fan control

Available with either a 3-inch (AF-3) or 7-inch (AF-7) probe which maintains the bimetal sensing element in a completely exposed position in the air stream. This rapid response position of the sensing element, combined with a snap-acting switch mechanism, provides fast and efficient furnace fan control. Adjustable with a range of 90° F. Maximum temperature 300° F. Factory differential is 25° F. Can be supplied with a closer or wider differential on request.

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Therm-O-Disc

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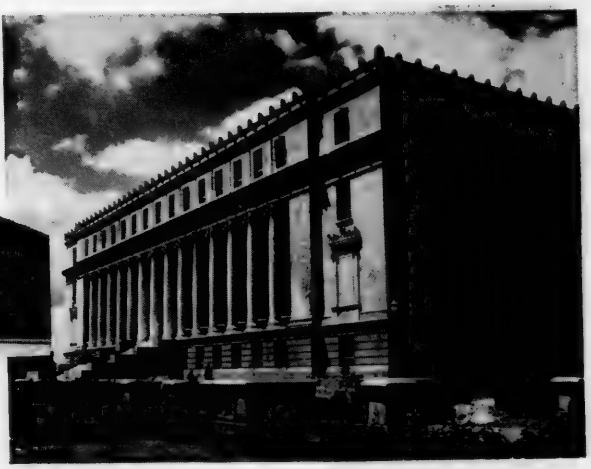
• **USE OLD DUCTS**—The unusual height resulted from efforts to save on expenses by utilizing the ducts of a natural-air circulation system installed about 1928. The old system supplied unconditioned air to the nave through floor openings under the pews and exhausted the warm air through seven openings in the timbrel tile arches forming the 100-ft high ceiling. The new system uses the same floor and ceiling openings and substantially the same duct work, but in reverse. The modernization was achieved with the addition of very little new ductwork.

• **EXHAUST UNDER PEWS**—The design problem was posed by the nave's dimensions of 100-ft height, 65-ft width, 200-ft length, a 40-ft deep balcony, a volume of 1,300,000 cu ft, and a population of 1,960 persons. The system that was worked out provides an entering air temperature-difference range of 17.5 deg F at 50,000 cfm, to 25 deg at 35,000 cfm. The exhaust end of the system permits withdrawal of air from under the pews at a minimum rate of 29,000 cfm to a maximum rate of 44,000 cfm. Moderate withdrawal is necessary to avoid cold ankles and cold feet. During winter months, the old system may be used for heating.

According to the installer of the new system, Vermilya-Brown Co., Inc., New York City, tests showed that there is no audible noise in the pews from the inrushing overhead air and that no drafts of significance were reported by members of the congregation since the system was put into service.

Meyer, Strong, & Jones, New York City, are the mechanical and electrical consultants. Architect for the project is Collens, Willis & Beckonert, Boston, Mass.

The winged scarab trademark of Worthington Corporation, Harrison, N. J., is being replaced by a new trademark, as shown. Adoption follows by six years abandonment of "Worthington Pump and Machinery Corporation" which had been the corporate name for many years. More than 200 mechanical engineers were polled during a two-year study that preceded selection of the new trademark. Part of a complete company streamlining, the change is reflected also in a greater standardization. For example: the company estimates its standard-end suction centrifugal pumps now are available in 60,000 different selections through varying combinations of only 650 parts.



AT TEXAS A&M

Thermal Engineering year around central plant and multizone air conditioners are in operation in the Administration Building*, the Library*, the Memorial Student Center*, and the U. S. Dept. of Agriculture facility* at the Agricultural and Mechanical College of Texas. Many additional Thermal units are presently to be installed in the new Chemistry Building**.

*Hollis U. Bible, Consulting Engineer, Houston, Texas

**Bernard Johnson & Associates, Consulting Engineers, Houston, Texas

Thermal Engineering manufactures a complete line of central plant and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils and air-cooled condensers. Write for complete information and a list of satisfied users.

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WRITE FOR Bulletin 82 . . . spray nozzles, assemblies and parts for manual or automatic humidifying systems.

ALSO SUPPLIED . . . spray nozzles for evaporative condensers, air washers, cooling towers, spray ponds and roof cooling systems.

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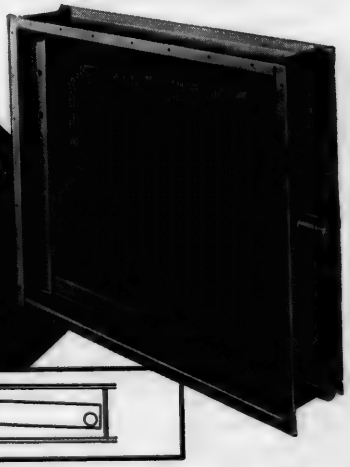
HEAVY DUTY STEAM COILS
(DISTRIBUTOR TYPE)



Tilted feature assures drainage of condensate whether used for vertical or horizontal air flow.

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Cover pieces at header and stub ends are perforated to allow passage of measured amount of by-pass air —gives increased coil capacity—eliminates hot end stress. Every square foot of face area produces equal heating capacity on full or modulated steam supply. Two row or one row available. ***Write for details***

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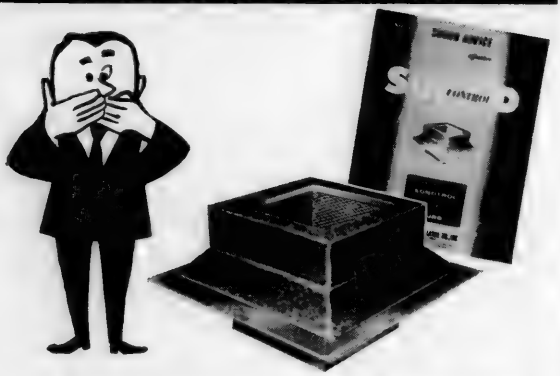
...FOR SOUND CONTROL



. . . a factory fabricated roof curb combining structural stability and sound attenuating qualities definitely superior to field-constructed curbs. The Sonotrol is priced competitively with on-the-job constructed curbs; it also defines and stabilizes dimensions. It is an excellent companion piece for all motor driven exhausters.

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(Book Reviews concluded from page 140)

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The costs of 150 different building types are covered in Building Cost Manual, a book prepared under the direction of The Joint Committee on Building Costs of the Chicago Chapter of The American Institute of Architects and The Appraisers Division of The Chicago Real Estate Board.

Each of the building types covered is described, detailed and illustrated with a photograph. The actual costs are broken down by trades and then these figures are shown on the basis of square foot and cubic foot costs.

This manual is based on more than 20 years experience in the assembly and analysis of data for this type of publication.

Building Costs Manual, prepared under the direction of the Chicago chapter, AIE and the Chicago Real Estate Board. Cloth bound, 8½ x 11 inches. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. Price, $15.

• • •

PIPE STANDARDS—Two revisions of American Standards —B16.9-1958, Steel Butt-Welding Fittings, and B16.25-1958, Butt-Welding Ends—have been approved by the American Standards Association and published by The American Society of Mechanical Engineers. Both standards are sponsored jointly by the Mechanical Contractors Association of America, the Manufacturers Standardization Society of the Valve and Fittings Industry, and The American Society of Mechanical Engineers. B16.9-1958 covers over-all dimensions, tolerances, and markings for wrought and cast carbon- and alloy-steel welding fittings, known as American Standard Steel Butt-Welding Fittings. The term "wrought" is used to denote fittings made of pipe, tubing, plate or forgings. B16.25-1958 covers the preparation of butt-welding ends of pipe, valves, welding neck flanges, and pipe fittings. It is also applicable to other piping components which are connected into the piping system by butt-welding. The standard includes requirements for re-entrant shapes for heavy wall ends, welding bevel profiles, inside contours for joints made with or without backing rings, and machining dimensions with their tolerances. Price is $1.50 for B16-9-1958 and $1 for B16.25-1958, from American Standards Association, 70 East 45th Street, New York 17, N. Y.

Chilled Water, Fan-Coil System—Engineering Experiment Station Bulletin 451 on Cooling the I-B-R Research Home with a Chilled Water, Fan-coil System, was prepared by Warren S. Harris, research professor of mechanical engineering, and Norman B. Migdal and Glenn R. Sward, former research assistants in mechanical engineering, all of the University of Illinois. This is the first bulletin published on studies with fan-coil cooling system. It contains results for the seasons of 1955 through 1957. Engineering Publications Offices, 114 Civil Engineering Hall, University of Illinois, Urbana, Ill. Price, 50 cents.

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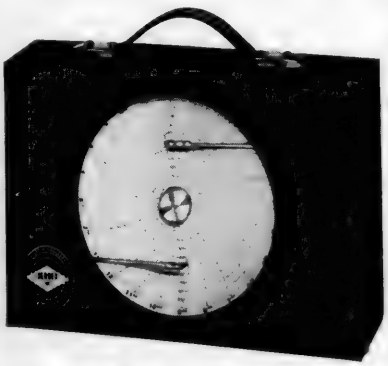

New Serdex Model 312C Hygrothermograph measures only 10½" x 7" x 3", weighs just 4½ lbs.

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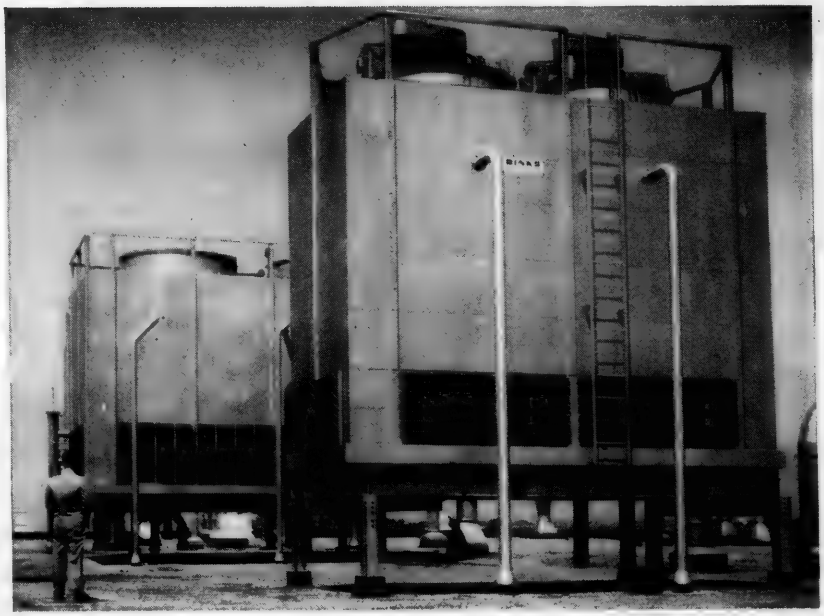

At the new Caterpillar Tractor plant in Decatur, Illinois, four Binks 2-K Series cooling towers play important roles in the manufacturing processes.

at Caterpillar's Decatur plant

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Ask your Binks branch office for a copy of Bulletin 333 and Bulletin 477-A or write direct to the address below. Binks engineers will be glad to answer your questions and help you solve your cooling problems. There's no obligation.

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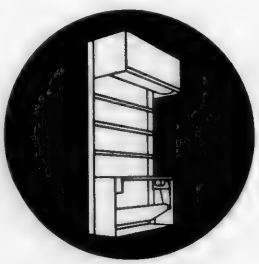

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COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available

ELECTRONICS CONFERENCE—1958 National Electronics Conference, sponsored by the American Institute of Electrical Engineers, Illinois Insitute of Technology, Institute of Radio Engineers, and Northwestern and Illinois Universities, to be held at the Hotel Sherman, Chicago. R. E. Hornacek, Publicity Committee Chairman, Illinois Bell Telephone Co., 208 W. Washington St., Chicago 6, Ill. ..... **OCTOBER 13-15, 1958.**

AGA CONVENTION—Annual convention, American Gas Association, at Convention Hall Auditorium, Atlantic City, N. J. Secretary of the Association, 420 Lexington Ave., New York 17, N. Y. ..... **OCTOBER 13-15, 1958.**

REFRIGERATION WHOLESALERS MEETING—Annual meeting of the Air-Conditioning and Refrigeration Wholesalers, at the Sheraton-Palace Hotel, San Francisco, Calif. Secretary of the Institute, 2607 N. High St., Columbus, Ohio. ..... **OCTOBER 22-24, 1958.**

PUBLIC HEALTH MEETING—86th annual meeting of the American Public Health Association, at Kiel Auditorium, St. Louis, Mo. Schless and Company, 14 W. 55th St., New York 19, N. Y. ..... **OCTOBER 27-31, 1958.**

TECHNICAL WRITERS CONVENTION—Sixth annual convention of the Society of Technical Writers and Editors, Inc., at the Shoreham Hotel, Washington, D. C. G. J. Goodstadt, public relations director of the Society, 11 Riverside Drive, New York 23, N. Y. ..... **NOVEMBER 17-18, 1958.**

PLASTICS INDUSTRY EXPOSITION—Eighth national plastics exposition of the Society of the Plastics Industry, Inc., at International Amphitheatre, Chicago, Ill., to be held concurrently with the SPI annual national conference, Morrison Hotel, Chicago. Secretary of the Society, 250 Park Ave., New York 17, N. Y. ..... **NOVEMBER 17-21, 1958.**

AIR POLLUTION CONFERENCE—The National Conference on Air Pollution, at Sheraton-Park Hotel, Washington, D. C. Surgeon General, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C. .... **NOVEMBER 18-20, 1958.**

POWER SHOW—23rd National Exposition of Power and Mechanical Engineering, under the auspices of The American Society of Mechanical Engineers, in conjunction with the Society's 78th annual meeting, at the Coliseum, New York. E. K. Stevens, president, International Exposition Co., 480 Lexington Ave., New York 17, N. Y. ..... **DECEMBER 1-5, 1958.**

EXPOSITION AND ASHAE CONVENTION—65th annual meeting, American Society of Heating and Air-Conditioning Engineers (Jan. 26-29, 1959) and 14th International Heating and Air Conditioning Exposition, Philadelphia, Pa. A. V. Hutchinson, secretary of the Society, 62 Worth St., New York 13, N. Y. ... **JANUARY 26-30, 1959.**

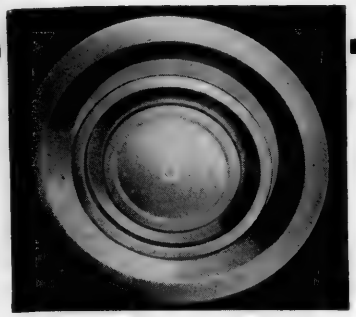
WESTERN METAL EXPOSITION—Eleventh Western Metal Exposition and Congress, of the American Society for Metals, at the Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif. R. Y. Bayless, assistant secretary of the Society, 7301 Euclid Ave., Cleveland 3, Ohio. ..... **MARCH 16-20, 1959.**

GAMA MEETING—Annual meeting of the Gas Appliance Manufacturers Association, at the Americana Hotel, Bal Harbour, Fla. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York, N. Y. ..... **APRIL 1-3, 1959.**

ASRE CONVENTION—Convention of the American Society of Refrigerating Engineers, at the Hotel Traymore, Atlantic City, N. J. R. C. Cross, secretary of the Society, 234 Fifth Ave., New York 1, N. Y. ..... **OCTOBER 30-NOVEMBER 1, 1959.**

ARI EXPOSITION—11th Exposition of the Air-Conditioning and Refrigeration Industry at Convention Hall, Atlantic City, N. J. Geo. S. Jones, Jr., managing director of Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C. ..... **NOVEMBER 2-5, 1959.**

ASHAE MEETING—66th annual meeting of the American Society of Heating and Air-Conditioning Engineers, and the 2nd Southwest Heating and Air-Conditioning Exposition, sponsored by ASHAE, in Dallas, Tex. The meeting will be at the Baker and Adolphus Hotels, and the Exposition in the Memorial Auditorium. Secretary of the Society, 62 Worth St., New York 13, N. Y. .. **FEBRUARY 1-4, 1960.**



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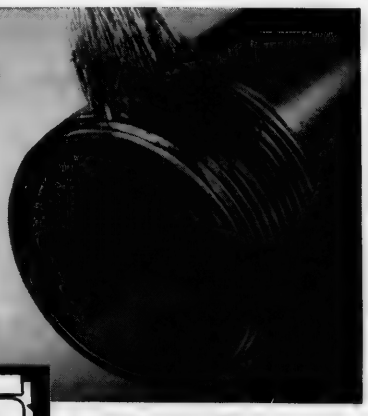

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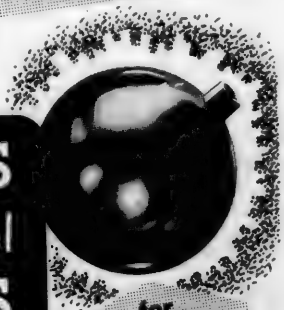

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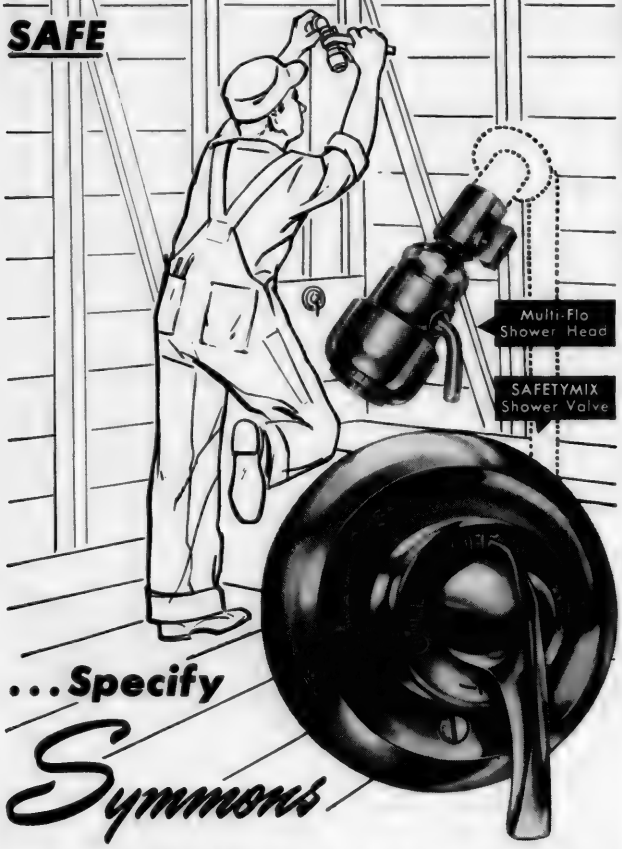

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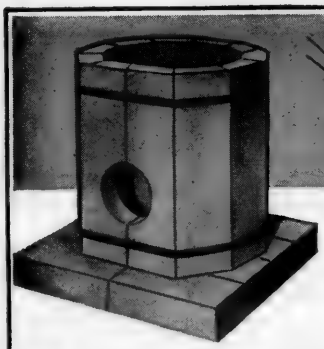

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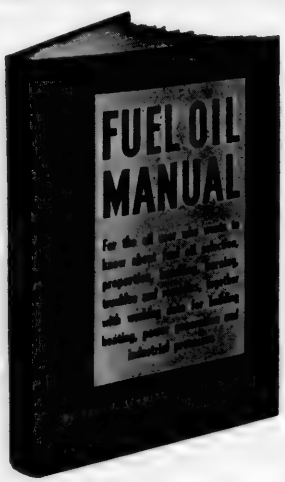

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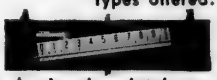

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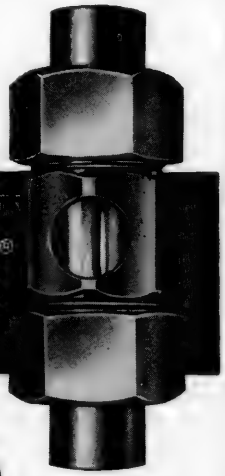

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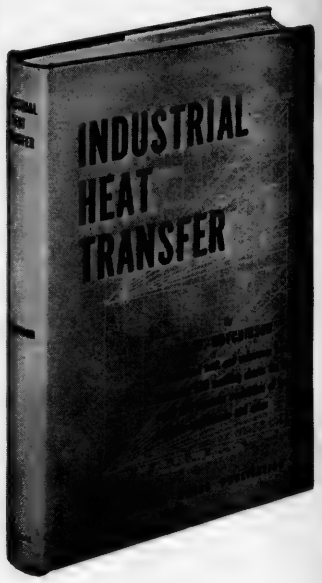

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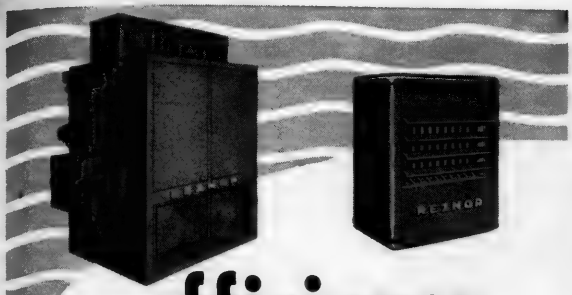

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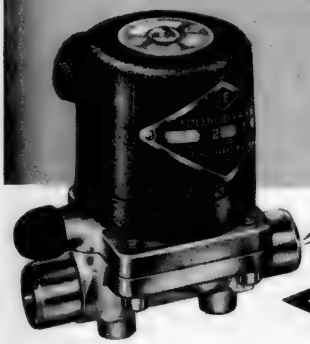

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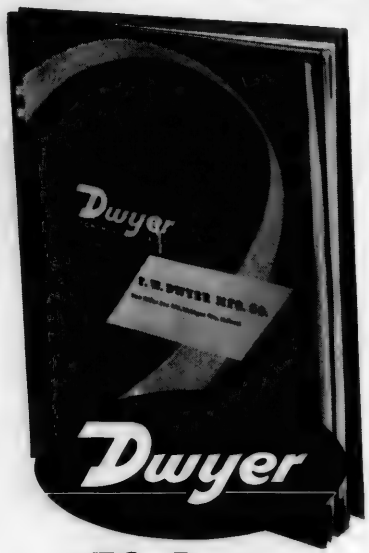

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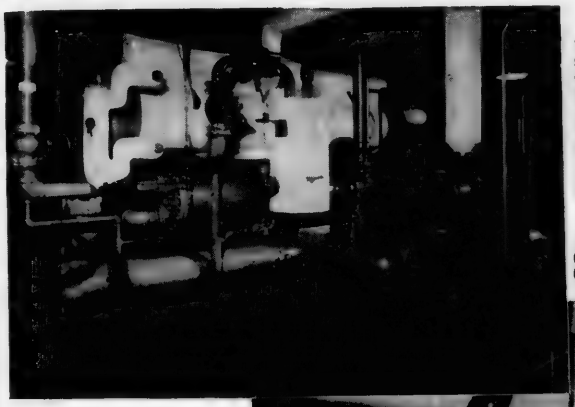
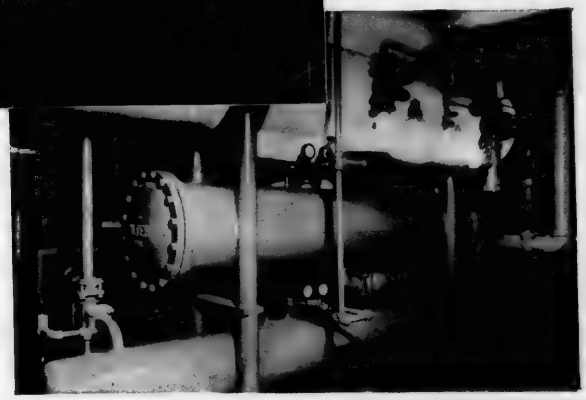


This Vilter air conditioning plant consists of a Freon shell and tube water chiller, shell and tube condenser, liquid receiver and a six-cylinder Freon VMC compressor, all installed in the Southwestern Bell Telephone Co., Olathe, Kansas.



Close up view of Vilter Condenser. Chiller is above. Receiver is below.

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Write for these helpful bulletins to The Vilter Manufacturing Company
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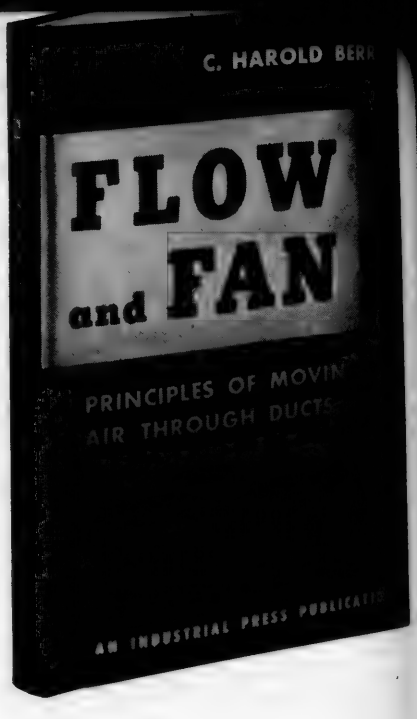

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Inside Front Cover — Item 200

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Page 1 — Item 201

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Page 2 — Item 202

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Page 5 — Item 203

RADIANT HEAT BOOKLET..... entitled "Heat Flow by Radiation in Buildings" is offered by multiple-layer aluminum insulation manufacturer. Author is well-known expert in the field of heat and vapor flow and thermal insulation.
Page 7 — Item 204

DISC EQUIPPED BRONZE VALVES..... offer top value in every component. For example, factor of safety in wall thickness of high tensile bronze body is many times higher than rating requires. Descriptive folder is available.
Page 9 — Item 205

UNIT HEATERS ..... are available for gas firing, electricity, steam, or hot water, in a variety of types and sizes. Company has everything you can need in the way of unit heaters. Bulletins available.
Pages 11-13 — Item 206

QUICK STEEL SERVICE ..... is guaranteed as company's service center starts delivery even as you place your order. Available are continuous-process, and electrolytic zinc-coated sheets and hot or cold-rolled sheets. Information available.
Page 15 — Item 207

CONDENSATE PUMPS ..... of this manufacturer eliminate the need for a custom job. A standard pump is available to meet all exacting requirements. Bulletins available.
Page 17 — Item 208

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Pages 18-19 — Item 209

INDUSTRIAL HEATING..... with company's warm air units in 8 industrial heater capacities is teamed with cooling coils for complete air conditioning jobs. Direct fired heaters from 400,000 to 2 million Btu for oil, gas, or combination fuel. Complete specifications available.
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Page 22 — Item 211

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Page 23 — Item 212

EXPANSION JOINTS..... made by this manufacturer will take any type of movement: lateral offset, angular rotation, off-tackle slants, etc. Made of stainless steel. Information available.
Page 24 — Item 213

DEPENDABLE HEATING PRODUCTS.. as well as a full line of air conditioning and refrigeration products are available from this manufacturer. Specified for new American headquarters of the Nestle Co., Inc., known for their fine food products. Information available.
Page 25 — Item 214

AXIAL FLOW FANS..... are recommended for really tough ventilating jobs where large volumes of air must be moved at variable pressures against unpredictable resistance within cramped space allotments. Over 136 models. Bulletin available.
Page 26 — Item 215

EVERY SOLENOID VALVE..... made by this company is power packed with patented coil for peak performance on every installation. Gives extra protection against burned out insulation and moisture failures. Bulletin available.
Page 27 — Item 216

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The items appear in the same order as the advertisements to which they refer, to facilitate obtaining further information after reading an advertisement.

NOTE: All advertisements are digested here except those received too late for inclusion. The Index of Advertisers lists all the advertisements in this issue.

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PLEASE PRINT — Oct. H-58

This service available only to U.S. and Canadian readers.

Name .....

Title or Job Function .....

Firm .....

Nature of Firm's Business .....

Street .....

City ..... **Zone** .... **State** .....

This card is void after Jan. 1, 1959

FLOATLESS PUMP CONTROLLER..... is a new and valuable accessory for sewage and drainage sump pumps, available only with this company's pumps. It has every advantage of other floatless controllers plus the advantage of being sealed. Bulletins available.
Page 28 Item 217

COUNTERFLOW HEATERS..... supplied by this manufacturer maintained 68 deg F in 75,000 sq ft warehouse at fuel cost of only 0.7 cent per sq ft for the month of January, 1958. Three 500,000 Btu and one 750,000 Btu gas-fired heaters did the job. Bulletin describes complete line.
Page 29 Item 218

REFRIGERATION SYSTEMS..... include unit air conditioners, compressors, to provide conditioned air, cold water, ice, cold rooms, to produce very low temperatures, or for human comfort, process work, quick freezing, research, etc. Information available.
Page 30 Item 219

AIR VENTS..... give top performance on steam unit heaters, heating systems, steam process work, hot water heating systems, domestic water, summer-winter units, and water process work. Information available.
Page 31 Item 220

PUMPS DELIVER QUIET HEAT..... because they operate without vibration. Advertisement shows school installation. No vibration eliminators or flexible connections to the piping are needed. Oversize shaft of special alloy steel and diamond-hard mechanical seal. Information available.
Page 32 Item 221

HEAT EXCHANGE EQUIPMENT..... offered by this company includes copper-lined hydropneumatic storage tank recently installed atop the 38-story Denver First National Bank Building. Also copper-silicon generators, pressure tanks, etc. Twenty-page storage heater catalog contains tables, dimensions, diagrams, and details.
Page 33 Item 222

COOLING WITH GAS..... provides years of trouble-free comfort when gas absorptive cooler is specified. This cooling can put commercial and industrial heating plants on a year around paying basis. Information is available.
Pages 34-35 Item 223

PRECISION-DESIGNED MOTORS..... are offered by company with more than 65 years of experience in solving motor-drive problems. Unique production facilities produce in volume the precision motor specifically designed for you. Information available.
Page 36 Item 224

ZONE CONTROL CABINETS..... are engineered for installations where a single unit must provide varying degrees of conditioned air for several zones or rooms. Quiet operating, compact, flexible, and dependable, they perform with peak economy. Bulletin available.
Page 37 Item 225

THE FIRST MAJOR ADVANCE..... in twenty years in the field of turbine refrigeration equipment is claimed for this manufacturer's centrifugal water chiller. Information is available.
Pages 38-39 Item 226

HIGH VELOCITY UNITS ..... provide constant volume under all conditions. Exclusive feature assures precision control of air volume and temperature. Information available.
Page 41 Item 227

NON-SPRINKLER FIRE PROTECTION specifying aid was prepared by this company in response to many inquiries. Presents a concise key for relating wide range of fire protection factors. Not a catalog, but offered free.
Pages 42-43 Item 228

BOILER-BURNER UNITS..... for oil firing are offered in complete line in net capacities from 65,000 to 2,709,600 Btu per hr. Burner and other components engineered and integrated to function as a unit. I-B-R tested and rated. Catalogs available.
Page 44 Item 229

GUARANTEED PERFORMANCE..... of every air conditioning job is possible when you specify the combination of company's electronic automatic controls and engineered air distribution devices. Complete information on combinations available in bulletin offered.
Pages 46-47 Item 230

ACOUSTICAL DUCT INSULATION..... provides notable insulation value per dollar. Absorbs fan and motor noises, soaks up sounds transmitted through ducts, increases system efficiency. Information available.
Page 48 Item 231

FORCED DRAFT GAS-OIL BURNER.... enables forced draft firing for smaller boilers, especially the increasingly popular sealed firebox Scotch boiler. Specifications available.
Page 49 Item 232

SCHOOL AIR CONDITIONING..... is discussed in two-page advertisement by company's engineering vice-president. New school catalog offered, contains complete data on dual-duct, high velocity unit.
Pages 50-51 Item 233

POWER ROOF EXHAUSTERS..... are offered for the first time in aluminum with belt drive to combine high discharge with low-contour appearance. Both centrifugal and axial units offered. Information available.
Page 52 Item 234

COPPER PIPE..... is found less costly to install, needs less room, and is more easily handled, testifies plumbing and heating contractor quoted. Company's distributor is prepared to fill all your needs. Information available.
Page 53 Item 235

AIR CONDITIONING LINE..... said to be the most complete in the world. Company is signing on a select group of new dealers. Complete line makes possible "custom-quoting" of every job. Information available.
Page 54 Item 236

COMBUSTION PACKAGE..... fires low cost heavy oils in medium sized heating plants; provides forced draft firing to eliminate high stacks; and comes with control panel, firing and draft mechanisms, in factory-wired, tested units. Information available.
Page 55 Item 237

LARGE SIZE BLOWERS..... are this company's specialty. Quiet, trouble-free, dependable, these heavy duty fans are guaranteed. Built to NAFM standards. Motors built to NEMA standards. Bulletins available.
Page 56 Item 238

NEW SCOTCH BOILER..... for oil, gas, or oil/gas combination was the hit of the OHI show. Factory assembled and tested it is ready for final piping and wiring connections. Information is offered also on boiler-burner packages and the company's "old reliable" compact type boiler.
Page 57 Item 239

GAS-FIRED REFRIGERATION..... operates on absorption principle and provides trouble-free, economical cooling at U. S. Air Force Academy in Colorado. Automatically adjusts to varying loads. Information available.
Page 58 Item 240

REGISTER AND GRILLE CATALOG.... illustrates complete line for custom control of warm air heating and for uniform year-round heating and cooling comfort.
Page 59 Item 241

REGISTERS AND GRILLES..... are added to this company's lines of diffusers, filters, exhausters, high velocity mixing boxes, and Punkah louvers. Entire Stewart line acquired. Information available.
Page 61 Item 242

Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U. S.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 36, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

AIR CONDITIONING, HEATING AND VENTILATING

93 WORTH STREET

NEW YORK 13, N. Y.

RADIATOR VALVES, TRAPS, VENTS... are uniformly good when bought from this manufacturer. Radiator valve illustrated is truly packless. Extremely rugged, but never fails to close tight on steam. Catalog available.
Page 62 — Item 243

CONDITIONING COSTS CUT... because with this company's line you may select the right units from over 297 models, units that boast the lowest operating cost in industry. Maintenance costs, too, said to average out the lowest. Information available.
Page 63 — Item 244

REGISTERS AND GRILLES... offered by this manufacturer have been tested and approved by Anemostat Laboratories. Units feature silent flow "teardrop" louver design. Catalog contains complete data.
Page 64 — Item 245

COPPER AND BRASS TUBE... are produced by specialists in complete integrated plant designed specifically for the manufacture of tube, pipe, and rod. Over 80% of its business comes from repeat customers. Information available.
Page 66 — Item 246

REFRIGERANT CONTROL LINE... provides one complete line for both air conditioning and refrigeration: thermostatic expansion valves, refrigerant distributors, solenoid valves, suction line regulators, flooded evaporator controls, and reversing valves. Specification details offered.
Page 67 — Item 247

QUIET CENTRIFUGAL PUMPS... are the answer to noise problems in cooling tower installations. Noise, as well as the usual causes of unsatisfactory performance, has been engineered out. Catalog is available.
Page 69 — Item 248

CENTRAL CONTROL PANELS... increase efficiency, reduce air conditioning cost for any building. Over 350 installations in all types and sizes of buildings across the country. Company offers its experience at no obligation.
Pages 131-133 — Item 249

ELECTRIC CONTROL VALVES... offered in complete line, are quiet, small, reliable, rugged and fast. New two-position fluid power valve one-third smaller than ordinary electric valves and is especially suitable for radiators, convectors, and fan-coil units. Information available.
Pages 134-135 — Item 250

AIR-COOLED CONDENSERS... are re-designed and offered in a wider range. They also come job-ready for multi-circuit applications. Standard self-contained remote models, 2 to 25 tons. Information available.
Page 136 — Item 251

SAFE, ECONOMICAL PREHEATING... of No. 6 fuel oil using boiler steam and auxiliary gas-generated steam is Idea No. 4 in a series from this manufacturer. Further information is offered.
Page 137 — Item 252

PREFABRICATED VANE RAIL... eliminates layout, tab cutting, hole punching, etc. Savings up to 70% over old methods. Said to be best method ever devised for installing turning vanes in square elbows. Information available.
Page 138 — Item 253

ELECTRIC AIR DUCT HEATERS... provide forced air temperatures to 1050 deg F. For space heating or for adapting present air conditioning systems for central heating. Installed quickly in round or rectangular ducts. Bulletin offered.
Page 138 — Item 254

COPPER SIMPLIFIES PLUMBING... in big addition to Children's Hospital, Pittsburgh, Pa., where copper tube was used for sanitary drainage, water lines, oxygen, vacuum, and compressed air lines. Information on types K, L, M, and DWV available.
Page 139 — Item 255

ROOF VENTILATION LINE... meets all requirements efficiently and economically. Low contour units, high velocity units, wind-driven turbines, and exhaust fans. Catalog available.
Page 140 — Item 256

COPPER TUBE DELIVERY SYSTEM... speeds company's quality products through a continent-wide network of distribution depots. Complete quality control of copper and brass tube and pipe achieved through step-by-step supervision by specialists in wholly integrated mill. Information available.
Page 141 — Item 257

PACKAGED BOILERS... ensure profits by eliminating costly waste of time building the boiler on the job. Units completely pre-engineered, factory tested, ready for hookup to service lines. Information available.
Page 142 — Item 258

AIR-COOLED CONDENSER... won't rock, rattle or roar because engineers planned it that way. Condensers, available in 13 models, are dependable, too. Literature available.
Page 143 — Item 259

FLEXIBLE EXHAUST HOSE... is recommended for dust control. Made of strong neoprene coated cotton or nylon fabrics, spiral wire reinforced. Particularly good for elbows and moving hoods. Details available.
Page 144 — Item 260

DUAL-DUCT UNITS... are noted for their flexibility and ability to provide air conditioning year-round. Providing true simplicity in air conditioning, direct, automatic volume control is assured. Information available.
Pages 144-145 — Item 261

ZONE-CONTROL VALVE... ensures comfort in each area of the home or building but eliminates burning of fuel to furnish unwanted heat. Contains built-in auxiliary switch which automatically starts circulator or burner when any valve is in open position. Brochure available.
Page 146 — Item 262

NEW DATA SHEETS... offered by this company cover special problems solved by this company's products which provide safety in connection with equipment such as expansion tanks, stand-by pumps and HTW heaters.
Page 147 — Item 263

COOLING TOWER FANS... increase cooling tower efficiency with more air movement and less horsepower required. Corrosion resistant blades to 22-ft diameters. Information available.
Page 147 — Item 264

NEW FLOW SWITCH... makes or breaks a circuit when flow starts or stops. Will actuate an alarm, a signal, a motor, a burner, or metering device. Bulletin available.
Page 148 — Item 265

ADJUSTABLE SPROCKET RIM... with chain guide provides safe operation of overhead valve wheel, and is easy to install and operate. Catalog sheet and prices available.
Page 148 — Item 266

SAFETY RELIEF VALVES... available for every hot water boiler. Btu-rated as per ASME code. New bulletin tells the story.
Page 149 — Item 267

Circle numbers corresponding to the items and advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

INQUIRY CARD

Circle below item numbers on which you wish catalogs or further information

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
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PLEASE PRINT — Oct. H-59

This service available only to U.S. and Canadian readers.

Name .....

Title or Job Function .....

Firm .....

Nature of Firm's Business .....

Street .....

City .....Zone ....State .....

This card is void after Jan. 1, 1960

Ad-Digest

CONTROLLED HUMIDITY SYSTEM.... employs a moisture-absorbent liquid to provide dry air precisely as you want it. Over 20 years of service. Inexpensive to operate because no reheat is needed. Bulletins available.
Page 149 Item 268

FUEL BURNING SYSTEMS..... offer dependable, efficient and trouble free firing on new or existing boilers. Units are completely factory packaged. Information is available.
Page 150 Item 269

CONTINUOUS RIDGE VENTILATOR.... converts a roof ridge to a quick-acting, giant air valve economically. Data book offered supplies information on complete line of modern roof ventilators.
Page 151 Item 270

FURNACE CONTROL LINE..... includes furnace limit control and furnace fan control. The former is available either adjustable or non-adjustable, calibrated and pre-set to your specifications. Inquiries invited.
Page 152 Item 271

DISTRIBUTOR TYPE STEAM COILS... are of heavy duty construction. Tilted feature assures drainage of condensate whether used for vertical or horizontal air flow. Details available.
Page 153 Item 272

SPRAY NOZZLES..... and all related accessories for humidifying are now available from a single, dependable source. For industrial installations of every size. Everything but the piping, wiring and compressor. Bulletin available.
Page 153 Item 273

COMPLETE CONDITIONING LINE..... includes central plant and multi-zone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils, and air-cooled condensers. Company will supply complete information and a list of satisfied users.
Page 153 Item 274

EXHAUSTER PLUS SOUND CONTROL are called silent partners to answer your roof ventilation needs. New 12-page bulletin describes roof exhauster line, and another bulletin contains complete information on factory fabricated roof curb.
Page 154 Item 275

LOWER-PRICED RECORDERS ..... are available in line which includes new hygrograph with sensing element guaranteed accurate within plus or minus 5% for only $97.50. Thermograph may be added later for $27.50. Information offered.
Page 155 Item 276

COOLING TOWERS..... keep heat treating at new Caterpillar Tractor Small Plant, Decatur, Ill., under cool control. Failure of cooling equipment could be costly, so these dependable units were specified. Bulletins contain complete data.
Page 155 Item 277

AIR FILTER BULLETIN..... tells this company's story about its automatic renewable filter, handling millions of cfm now being installed throughout the country. Has quality features unexcelled by others.
Page 156 Item 278

PLASTIC LEAD SEAL..... is a compound that provides many services, for water, gas, oil, steam lines, but never washes out. One application lasts forever. Free sample offered.
Page 157 Item 279

STAINLESS STEEL FLOATS..... are offered for high pressure, high temperature, and for corrosion resistance. Catalog available.
Page 157 Item 280

ADJUSTABLE PATTERN DIFFUSER... is of all aluminum construction, has internal vanes for segmental air pattern adjustment, which is stable in intermediate angles—ceiling or duct mounted. Bulletin contains complete engineering data.
Page 157 Item 281

COMBUSTION CHAMBERS..... are engineered refractories built for performance and designed for easy, fast installation. Highest combustion efficiency for high or low-pressure burners. Information available.
Page 158 Item 282

SHOWER MIXING VALVE..... provides positive protection. Automatically eliminates the constant danger of scalds or chills. Costs no more than ordinary shower valves. Bulletin available.
Page 158 Item 283

PRECISION AIR FILTER GAGES..... are built for a lifetime of dependable service, widely used in large buildings, hotels, hospitals, and office buildings. Inclined-tube type, diaphragm-actuated dial type, and bell-actuated dial type. Bulletin available.
Page 159 Item 284

POSITIVE SEALING INDICATORS..... proven on thousands of production line installations have one piece extension gasket for positive sealing and fool-proof assembly. Six sizes. Complete line catalog available.
Page 159 Item 285

FAN ENGINEERING DATA..... offered in pamphlet published by this company which discusses low cost heating plant power-draft and industrial exhausting.
Page 159 Item 286

CENTRIFUGAL ROOF EXHAUSTERS... of lowest silhouette design enhance the beauty of building skylines. Forward or backward curved wheel within or without scroll housing. Certified cfm ratings. Bulletin available.
Page 160 Item 287

SOLENOID VALVES..... with multi-voltage coil simplify valve selection and reduce inventory and parts stock. For refrigerants or water. Catalog available.
Page 161 Item 288

GAS UNIT HEATERS..... react instantly, automatically, to requirements of their immediate surroundings, delivering where it is needed. Ideal for a variety of commercial and industrial buildings. Booklet available.
Page 161 Item 289

ROOM TEMPERATURE CONTROL..... for all types of buildings provides accurate and independent control on steam or hot water systems. A modulating control, it is completely self contained, has no electrical connections. Information available.
Page 161 Item 290

72-PAGE INSTRUMENT MANUAL..... is offered free to all users of gages and controls. Contains illustrations and complete details of company's gages, manometers, air meters, pitot tubes, flow meters, and combustion testing instruments.
Page 162 Item 291

AIR CONDITIONING SYSTEMS..... bring "custom climate" to Kansas telephone offices. All components supplied. Helpful bulletins are offered.
Page 163 Item 292

HIGH STATIC PRESSURE FANS..... deliver up to 8 inches of water SP for high velocity air conditioning systems. Available in 7 sizes with capacities from 2500 to 22,000 cfm. Bulletin available.
Inside Back Cover Item 293

TEMPERATURE TRANSMITTER..... of the remote bulb type for pneumatic transmission systems is offered. Measures and transmits, to a pneumatic receiver at a control center, temperatures in ducts, pipes, tanks, or other equipment. Bulletin available.
Back Cover Item 294

Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U. S.

BUSINESS REPLY CARD

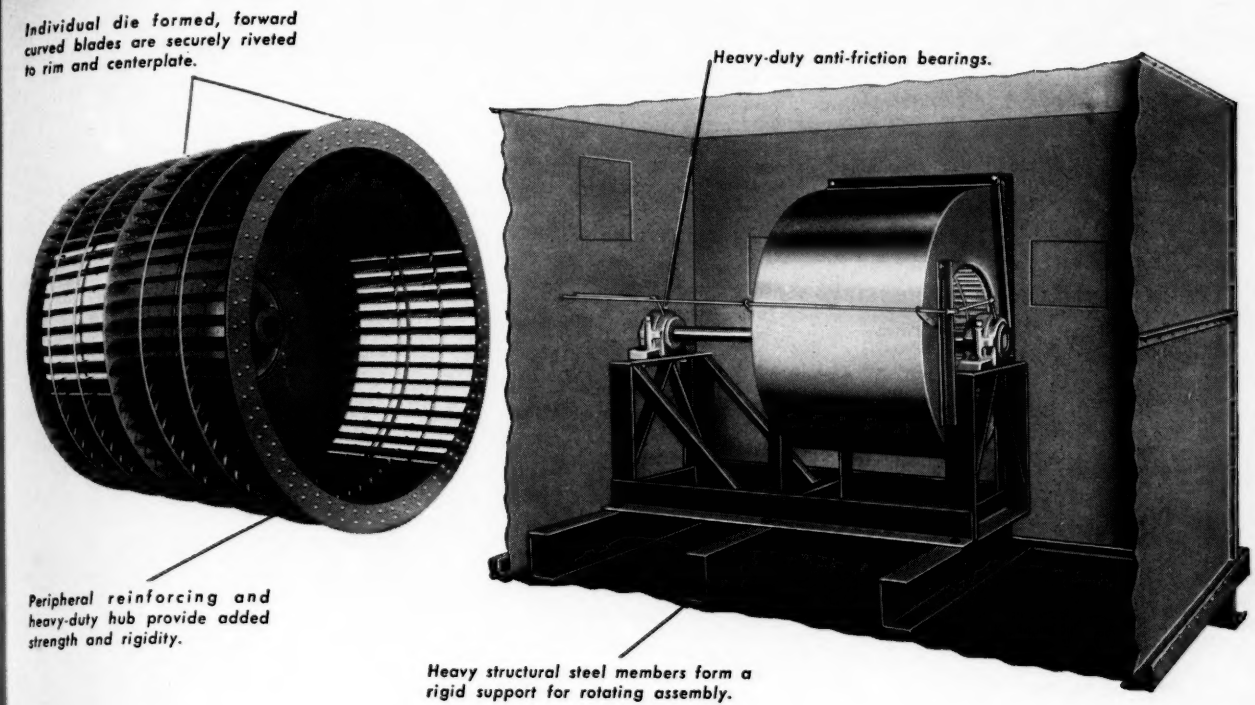
FIRST CLASS PERMIT NO. 53, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

AIR CONDITIONING, HEATING AND VENTILATING

93 WORTH STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE


Individual die formed, forward curved blades are securely riveted to rim and centerplate.
Heavy-duty anti-friction bearings.
Peripheral reinforcing and heavy-duty hub provide added strength and rigidity.
Heavy structural steel members form a rigid support for rotating assembly.

PROBLEM: High Velocity Air Conditioning Systems—to 8" SP

SOLUTION: Clarage Hi-Static Multitherm Units

High operating speeds, high duct velocities, high pressures — signal the choice of Clarage Hi-Static Multitherm Units. Available in 7 sizes with capacities from 2,500 to 22,000 CFM.

Unit components on the up-stream side include filters, humidifiers, cooling coils, and heating coils as required. In addition, the Hi-Static can be furnished in a sprayed coil type unit.

As shown above, special care in the design and construction of the fan section insures a stable, smooth operating unit. In every respect the Hi-Static Multitherm has what it takes for high velocity, conduit type air conditioning systems.

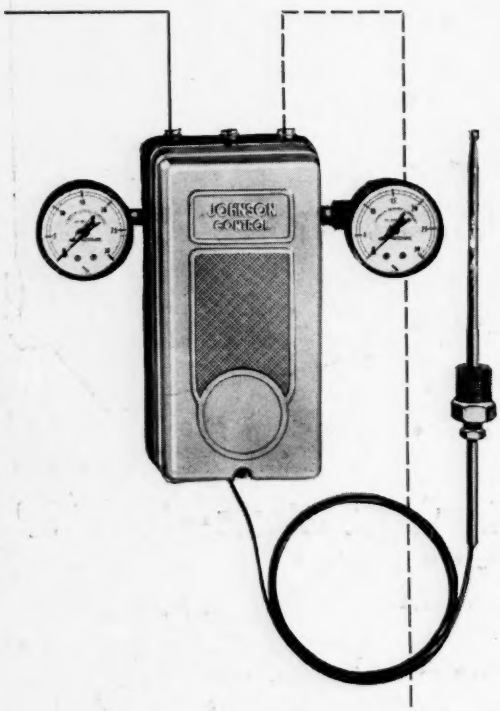
Write today for Bulletin 1312. Clarage Fan Co., Kalamazoo, Mich.

CLARAGE

... dependable equipment for making air your servant

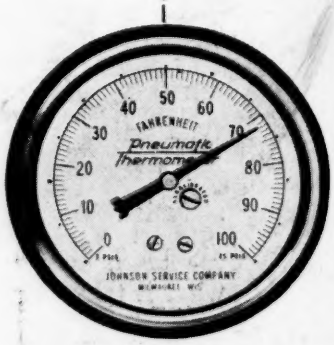
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

T-I220 REMOTE BULB TEMPERATURE TRANSMITTER
FOR PNEUMATIC TRANSMISSION SYSTEMS



- Measures and transmits, to a pneumatic receiver at a control center, temperatures in ducts, pipes, tanks or other equipment requiring accurate remote temperature measurement and control. The pneumatic receiver at the central panel provides, singly or in any combination, centralized indication, control or recording of the transmitted temperature.
- Compensated liquid filled measuring element.
- Pneumatic sensitivity feature (feedback) assures stable, highly accurate response over the entire temperature range.
- Transmission of temperature measurements by this specially designed instrument is unaffected by humidity, ambient temperature, transient electrical currents, voltage fluctuations or other variables.

For full details, write for Bulletin T-1220. Johnson Service Company, Milwaukee 1, Wisconsin.



applications of pneumatic transmission . . .

Pneumatic transmission systems for centralized indication and control are applied to all types and sizes of air conditioning, heating and ventilation systems. Johnson's complete line of pneumatic transmission and control center instrumentation, much of it developed exclusively for this purpose, allows the *widest choice of features* to meet the exact needs of the individual building.

Ask a local Johnson engineer to give you the complete story.

→ TO RECEIVER-CONTROLLER

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885